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THE PROGRESSIVE SOLUTION of human disease problems during recent years has been considerably advanced by the generous financial support of numerous organizations. Grants-in-aid to investigators, many of whom are located at widely separated universities and small research foundations, have stimulated a multiplicity of viewpoints and methods of approach. When investigators are free to select and pursue the research of their choice, the development of such concepts is favored. In smaller laboratories, long-range programs along fundamental lines tend to develop, since there is no immediate urgency for clinical application.

In this laboratory a new research approach to the cancer problem has been based upon Roger J. Williams' concept of genetotrophic disease, which, though stemming from hereditary roots, is alterable by nutritional means. Recent advances in biochemical genetics have established a firm theoretical foundation for this concept. Nutrition plays an important role in a number of pathological conditions, including cancer, and our own work has shown that nutritional factors can alter susceptibility to cancer.

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Reduced to a cellular or enzymatic basis, it is probable that a great number of pathological conditions have their roots in metabolic malfunction. Although all these metabolic processes operate within the genetic framework of the individual, it is apparent that many should be susceptible to attack by nutritional means—in a very broad sense. It is quite likely, therefore, that the genetotrophic disease concept may be applicable to a very diverse group of illnesses in addition to alcoholism, mental disease, and cancer. This may well be the most practical approach to the investigation of degenerative diseases and to the entire problem of geriatrics, and may make possible preventive treatment before extensive and irreparable damage has occurred. In effect, man's life span could be prolonged to more nearly its theoretical length, and at the same time this would help solve one of the great problems of our time; namely, the premature deterioration of the human individual. The prolongation of human creative productivity for even a short time would prevent untold cultural and economic loss.

A more immediate application would be to use the technique for selecting individuals able to withstand adverse environmental conditions—an important consideration in national defense. In addition, it would make possible prophylactic treatment of individuals against the deleterious effects of adverse environments, as well as those of aging. The possibilities inherent in the ramifications of the genetotrophic disease concept are limited only by the ingenuity of the investigator.

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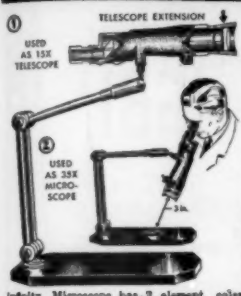

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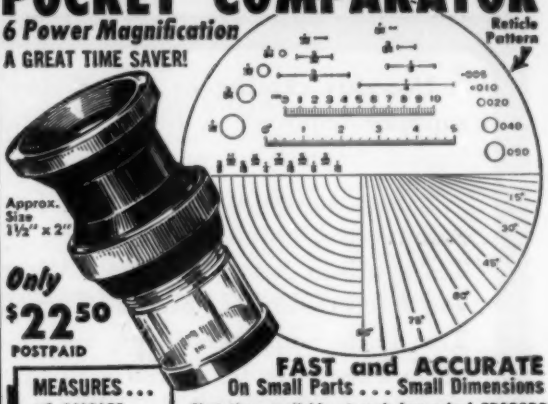

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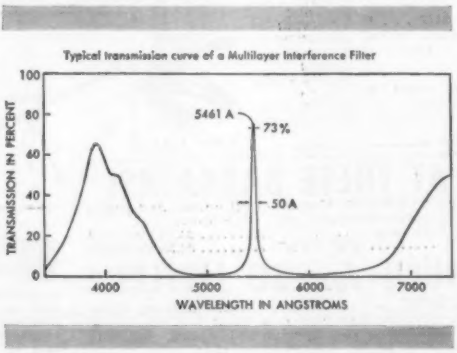

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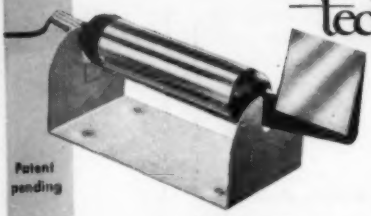

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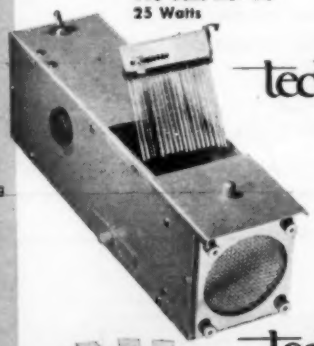

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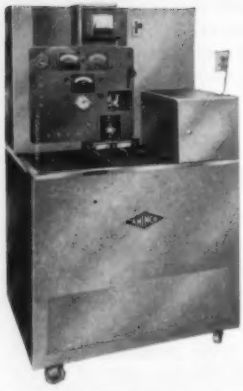

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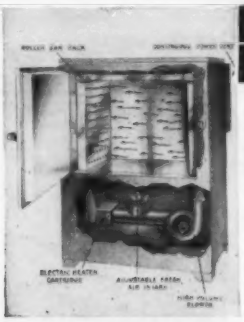

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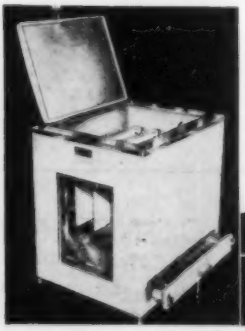

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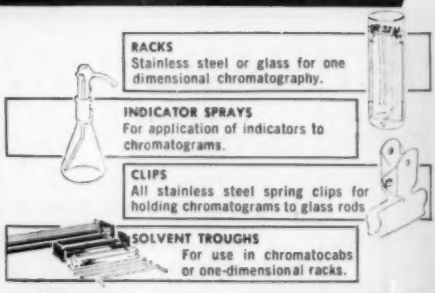

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NATIONAL ACADEMY OF SCIENCES

Abstracts of Papers Presented at the Annual Meeting
April 27–29, 1953, Washington, D. C.

Magnetic Fields of the Sun

Harold D. Babcock and Horace W. Babcock
Mount Wilson and Palomar Observatories

Magnetograms of weak fields on the surface of the sun are being obtained daily. The campaign on this problem, initiated in 1912 by George E. Hale, has resulted in the development and application of superior diffraction gratings yielding a resolving power of 600,000 and a dispersion of 11 mm/A, as well as a photoelectric detector for minute Zeeman effects that is free of systematic error. These, in combination with an alternating electro-optic analyzer and a scanning system, permit conformal magnetic mapping of the sun's disk in a pattern of 19 or more parallel traces with a sensitivity of 1 gauss. Daily records cover 8 months, and observations are planned for the complete solar cycle.

A variety of bipolar or complex multipolar fields of intensity from 2 to 30 gauss and having a fine structure is usually found in heliographic latitudes up to $+40°$, even in the absence of visible sunspots. The intensity and extent of the solar magnetic fields vary from day to day. The fields precede and follow the appearance of visible spots. Occasional weak but extensive unipolar magnetic areas are observed in low latitudes. Special attention has been given to high latitudes above $\pm 60°$ where there is evidence of a weak but persistent dipolar field opposite to that of the earth. The mean polar intensity is currently of the order of 5 gauss, and the dipole moment is estimated to be approximately $+2 \times 10^{33}$ gauss cm^3.

Spectroscopic Studies of the Association of Amides in Solution

Richard M. Badger and Hector Rubalcava
California Institute of Technology

To clarify some apparent anomalies in the infrared observations on polypeptides and related substances, a systematic investigation of the simpler amides is being made. Part of a detailed study of the amides in solution will be reported.

In the region of the fundamental N—H frequencies in the infrared the lower unsubstituted amides show essentially identical spectra. In carbon tetrachloride solution it can be shown that the five spectral components attributable to associated molecules must be due to one species, a cyclic dimer. The enthalpy decrease on association is 7900 cals/mole of dimer, or 3950 cals/N—H . . . . O hydrogen bond.

An interpretation is given of the complex structure of the dimer spectrum, and differences between the spectra of the unsubstituted and N-substituted amides are discussed in relation to structure.

Effects of Early Experience on Mating Responses in Male Rats

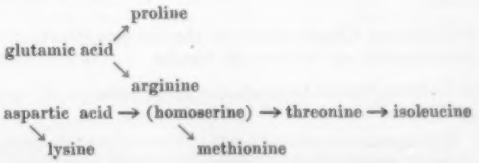
Frank A. Beach and Jerry Kagan, *Yale University*

Male rats were maintained in individual living cages from 36 days of age until the end of the experiment. During the "Conditioning Period" (36th–98th day of age) the animals were divided into four groups and given different kinds of experience. Males in Group I were exposed once each week to a receptive female of their own age, Group II rats were exposed at weekly intervals to a second male, members of Group III were placed once a week in the empty observation cage, and Group IV animals received no conditioning. Beginning at 99 days of age, all rats were given a series of "Critical Tests" with a receptive female. In these tests the groups did not differ significantly with respect to the number of males displaying some copulatory behavior, but the complete mating pattern, including ejaculation, was more than twice as frequent for the males lacking previous contact with other rats (Groups III and IV), than for animals that had been exposed to either males or females during the conditioning period (Groups I and II). Analysis of the data indicated that patterns of social behavior that had been formed before complete mating was physically possible tended to persist in adulthood and partially to inhibit the normal sexual responses.

Synthesis of the Aspartic and Glutamic Families of Amino Acids by *Escherichia coli*

E. T. Bolton, R. Britten, and D. B. Cowie
Carnegie Institution of Washington, Washington, D. C.

The patterns of amino acids synthesized from aspartic or glutamic acids are characteristic and comprise two well-defined families. Relationships between the families and among the members of each have been worked out. For this purpose the isotopic competition method has been extensively employed. This method takes advantage of the fact that labeling of an amino acid, which ordinarily occurs when cells are grown in simple media containing a tagged molecule, may be specifically suppressed by supplementing the medium with an appropriate metabolite. Various cultures have been prepared in this way and analyzed. Specific radioactivity measurements have been made on the amino acids isolated from *E. coli* proteins, and appropriate degradative procedures employed to determine the intramolecular location of tracer isotope. The synthetic sequences found are shown in the scheme below:



The sequences are practically irreversible, although interconversions between aspartic and glutamic acids occur. The amino acids shown constitute nearly 60% of the protein of *E. coli* and account for 90% of the polar side chain amino acid residues.

A General Explanation for the Superficial Aspects of Existing Organic Reefs

Preston E. Cloud, Jr., *U. S. Geological Survey*

A general explanation is possible for the superficial aspects of existing organic reefs. This involves the effects of a recent 6-ft net fall of sea level, coupled with slight recovery from the lowest point of fall. Evidence for the 6-ft fall is found in all tropical oceans. Its cause is seen in renewed growth of ice caps since the postglacial optimum.

The surfaces of reefs that lay within 6 ft of sea level when the 6-ft fall began were subject to truncation by wave erosion and ordinarily support few reef-building organisms today. Conversely, present sites of most flourishing reef surfaces must then have been more than 6 ft below sea level. The low ridge of coralline algae peripheral to many reefs is believed to have grown up from the beveled outer margin with decline of bench reduction and initiation of sea-level recovery. Such factors may also stimulate local renewal of coral growth, especially at reef margins. Tectonic influence locally alters the general scheme.

The comb-tooth pattern of radial grooves and spurs at reef fronts is attributed primarily to abrasion by undercurrents, especially during reduction of elevated reef surfaces. The preponderance of groove systems off windward reefs is related to preponderance of reef islands to windward. Surf-driven water, barred from the lagoon by islands, streams seaward in detritus-laden undercurrents that furrow the reef margin. Organic overgrowth in the noneroding parts of surge channels later obscures the primary erosional effects.

The abundance of habitable low reef islands is also attributed to the 6-ft eustatic fall. If present world temperature increase continues, however, most such islands will disappear again beneath a rising sea in 1000–2000 years.

The Physiology of the Gastric Antrum

Lester R. Dragstedt and Edward R. Woodward
University of Chicago

Previous studies have indicated that the antrum of the stomach provides a hormone for the stimulation of gastric secretion. When the antrum of the stomach is excised in dogs, gastric secretion falls off to a low level, but if the antrum is transplanted into the colon as a diverticulum, a sustained hypersecretion of gastric juice is produced. The development of tension within the antrum as a result of peristalsis stimulates gastric secretion, whereas the application of acid solutions to the antrum mucosa causes inhibition. The possible significance of these findings in the regulation of gastric secretion is discussed.

Preliminary Observations of the Geographical Distribution of Auroras in Alaska

C. T. Elvey, Harold Leinbach, and Joan Hessler
Geophysical Institute, University of Alaska

S. Chapman has pointed out that a new type of diagram showing geographical incidence (overhead occurrence) of auroras, as contrasted with Fritz' diagrams showing the geographical distribution of frequencies of auroral visibility, is needed for theoretical studies.

A program has been set up in Alaska to gather such data and this paper presents a summary of the geographical distribution obtained from previous auroral observations, along with those that have been obtained to date on this program.

A proposed system for the collection of data on a worldwide basis and the recording of this data on punched cards is presented.

Exsolution Phenomena and the Magnetic Properties of Rocks

John W. Graham
Carnegie Institution of Washington, Washington, D. C.

Physical and chemical properties of several Pre-Cambrian diabase dikes having magnetizations opposed to the earth's present magnetic field were studied in an effort to account for the inverse magnetization. The magnetically separable material is an intimate admixture of at least three mineral species: magnetite and maghemite (both strongly ferromagnetic) and ilmenite (essentially nonmagnetic). Experiments to duplicate the magnetic behavior of these rocks during their initial cooling cannot be made owing to the nonreversible conversion of maghemite to hematite at elevated temperature. Maghemite originated in these rocks by low-temperature oxidation of primary magnetite. Magnetization experiments show that the inverse magnetic moment must be attributed to particles having high coercive force, and that there is present, in addition, a significant quantity of essentially demagnetized ferromagnetic material. These observations make it seem reasonable to think that, when these dikes were injected, the earth's magnetic field had its present-day sense, and the reversal of the magnetization resulted from the partial oxidation of a primary magnetite that during cooling had been minutely subdivided by ilmenite exsolution lamellae; the maghemite developed within the magnetite and acquired an inverse magnetization from the fringing external fields of surrounding magnetite particles still magnetized in the original direction; the moment of the sample was thus gradually built up in the reverse direction as the larger particles of magnetite were oxidized and demagnetized. Based on this mechanism, a number of ways can be proposed by which sediments, deposited with the earth's field in its present-day sense, can ultimately acquire an inverse magnetization.

Learning by Rhesus Monkeys on the Basis of Manipulation-Exploration Motives

Harry F. Harlow, *University of Wisconsin*

Psychological motivational theory has emphasized the importance of internal drives as motivational mechanisms. There is every reason, however, to believe that exteroceptive stimuli provide just as basic and important motivational sources as the internal drives. These externally elicited motives are described by such names as curiosity, manipulation, exploration, and play.

Discrimination learning, based on manipulation motives only, has been demonstrated in monkeys. A metal-covered panel holding five pairs of differentially colored screw eyes, one color correct, the other incorrect, was presented to three rhesus macaques. The correct screw eyes were removable, the incorrect screw eyes were fixed and immobile. The monkeys showed progressive and statistically significant improvement in the day-to-day performance on 7 problems, each tested for 4 days. Furthermore, there was no indication of loss of motivational strength throughout 35 test days.

Discrimination learning by monkeys was also demonstrated on the basis of visual exploration. The monkeys were placed in a dimly illuminated cage covered by a box with two windows so designed that they could be covered by differentially colored cards. Selection by the monkey of the incorrectly colored window produced no effect; selection of the correct window was rewarded by permitting the animal to look through the window for a 30-sec period.

All the monkeys learned color discriminations and in one test showed no diminution of visual exploration strength throughout a 4-hr period of continuous testing.

Electrical Responses to Illumination of Isolated Visual Receptor Elements

H. K. Hartline, E. F. MacNichol, Jr., and H. G. Wagner
Johns Hopkins University, Baltimore, Maryland, and Naval Medical Research Institute, Bethesda, Maryland

Excitation of the eye by light is accompanied by an alteration of the electric potential difference measured across the layer of visual receptors (retinal action potential). The relation of this action potential to the discharge of optic nerve impulses has been studied in single receptor units (ommatidia) dissected from the eye of an invertebrate (*Limulus*). Electrical responses to light have also been observed in receptor units by means of very small micropipette electrodes thrust into the receptor elements. Apparently, such an electrode often enters one of the sensory cells of the ommatidium; we then observe a resting polarization that is altered by illumination of the ommatidium. Two types of response to light have been observed: rapid, spikelike fluctuations in potential, synchronous with the impulses discharged in the nerve-strand from the ommatidium, and slower, steady depolarizations (pipette electrode becoming less negative with respect to the outside medium). When both types were present at the same time, the amount of depolarization was linearly related to the frequency of the spikes. Often, however, elements were found in which a discharge of spikes occurred in response to illumination, with no perceptible depolarization. In other cases, depolarization took place without any spikes being discharged. Inhibitory effects have also been observed when nearby areas of the eye were illuminated.

A Neutron Diffraction Study of Magnesium Ferrite

J. M. Hastings, L. M. Corliss, and F. G. Brockman
Brookhaven National Laboratory, Upton, Long Island, and Philips Laboratories, Inc., Irvington-on-Hudson, New York

Neutron diffraction patterns have been obtained for polycrystalline magnesium ferrite. Magnesium ferrite, a ceramic-like material, is ferromagnetic at room temperature. Néel has proposed a theory based on an uncompensated antiferromagnetism, or ferrimagnetism, which accounts for the observed magnetic behavior of the ferrites. The diffraction patterns which we obtain consist of a superposition of coherent nuclear and magnetic scattering, which may, however, be separated by means of a suitably oriented external magnetic field. The analysis of the nuclear scattering permits a simultaneous determination of the degree of inversion, which for the specimen used is 0.88 ± 0.01, and the u-space group parameter to which the value 0.381 ± 0.001 is assigned. The magnetic scattering can be accounted for only if one assumes antiferromagnetic coupling of the magnetic ions and is found to be in good quantitative agreement with the Néel model. The form factor for the magnetic scattering is, within experimental error, identical with that previously obtained for nickel ferrite. The predicted saturation magnetization based upon the diffraction data is in very good agreement with the experimentally measured value.

Serological Reactivity of Synthetic Polyglucoses

Michael Heidelberger and Alan C. Aisenberg
College of Physicians and Surgeons, New York

Synthetic polyglucoses, prepared by heating glucose in the presence of condensing agents, were found to give specific precipitates with antibodies in a number of antipneumococcus horse sera. Qualitative tests were particularly strong in antisera to pneumococcal Types II, IX, XII, XX, and XXII. Quantitative analyses demonstrated that type-specific antibodies and antibodies to the species-specific "C" polysaccharide were responsible for the reactions. From one third to one half of the antibody could be precipitated from antisera to Types IX, XII, XX, and XXII by the fractions most easily separable from aqueous solution by means of alcohol and therefore presumably those of largest molecular size. Fractions obtained at higher concentrations of alcohol, or degraded by means of partial hydrolysis, precipitated less antibody and gave precipitates in fewer antisera than the first fractions. Two bacterial dextrans and a partial hydrolytic product of a dextran gave somewhat similar reactions. Chemical implications of the data are discussed.

Immunological Specificity of Polyglucoses of Plant and Animal Origin

Michael Heidelberger, Alan C. Aisenberg, Gerti T. Cori, W. Z. Hassid, and Eugene Pacsu
College of Physicians and Surgeons, New York, Washington University School of Medicine, University of California, Berkeley, and Princeton University

Glycogens from corn, oysters, rat liver and carcass, rabbit liver, and dog liver gave specific precipitates in the cold with antibodies developed in the horse to the pneumococcal Types II, IX, XII, XX, and XXII. These sera were also the ones which reacted most strongly with synthetic polyglucoses and dextrans. Saliva destroyed the serological reactivity of corn and oyster glycogens, the only ones so tested. Amylopectins and a limit dextrin also gave precipitates, but of smaller size. Unstable amylose solutions prepared by solution of amylose in alkali, neutralization, and dilution precipitated normal sera nonspecifically, but appeared to give heavier precipitates in antisera to pneumococcal Types IX, XII, and XXII than in other sera. Quantitative, as well as qualitative, data on the reactions are given. Limited deductions appear warranted as to the relation between chemical constitution in the polyglucose group and immunological specificity.

The Worldwide Gravity Program of the Columbus Group

Weikko A. Heiskanen, *Ohio State University*

The primary objectives of geodesy are the determination of the dimensions of the best reference ellipsoid for the earth and the establishment of accurate control points for map making. The triangulation in conjunction with astronomical observations can determine the size and

shape of the earth as well as the coordinates of the triangulation points. However, as triangulations cover only a small part of the continents and fail completely over the oceans, many geodetic systems exist. The discrepancy between two systems at points common to both can be as great as 500–2000 meters, because sea level (geoid) does not agree with any adopted reference ellipsoid. To convert to one common system for the whole earth, the undulations of the geoid N, and the components of the deflections of the vertical, ξ and η, must be determined at the initial points of different geodetic systems.

The gravimetric method can give N, ξ, and η, but it also yields much more. Combined with the astronomical observations, it gives without triangulation the necessary control points for mapping. Combined with the existing arc measurements, it checks the dimensions of the adopted reference ellipsoid. The only prerequisite is a sufficiently dense net of gravity stations.

With these advantages of the gravimetric method in mind, and encouraged by the results obtained particularly in Finland, Great Britain, the Netherlands, Russia, and the United States, the worldwide gravity program of the Columbus Group was established 2½ years ago. The progress of this project, as well as the necessary steps for its full-scale realization, are discussed.

The Photoperiodic Reaction

Sterling B. Hendricks and H. A. Borthwick
U. S. Department of Agriculture, Beltsville, Maryland

The photoreaction controlling photoperiodism in plants, germination of some seed, etiolation changes in seedlings, and many other morphogenic responses is found to be the reversible isomerization of the light-sensitive pigment. Time measurement in photoperiodism is accomplished by the dark reaction of the infrared-absorbing form changing to the red-absorbing form. The isomerization, by way of illustration, can well be of a cis- to a trans-modification. In any case, the photoexcited state is common to the two modifications of the pigment. Evidence is given that the biological response of a sample population varies either with the amount of one pigment or with the ratio of the two pigments. Progress has been made on measuring by physiological response the overlapping absorptions for the two forms in the blue-violet part of the spectrum relative to the previously measured absorptions at longer wavelengths where the overlap is not confusing.

The Reduction of Radiation Damage to Living Cells by Treatment after Exposure

Alexander Hollaender, G. E. Stapleton, and Daniel Billen
Oak Ridge National Laboratory

Postirradiation recovery after exposure to massive doses of x-rays of certain strains of mice has been observed after transplantation of nonirradiated spleen (Jacobson) or bone marrow (Lorenz). No cell-free extracts have been found to stimulate the spleen or spleen brei transplantation. A somewhat different approach—i.e., incubation of x-irradiated bacteria in the presence of yeast or meat extracts at suboptimal temperatures—has shown significant increase in viable cells. The optimal recovery temperature varies with different strains of *Escherichia coli*: for B/r, 18° C; Crook, 12° C; and Texas, 21° C—lower than optimum growth temperatures for all three strains; also the total oxygen consumption of irradiated cells is increased at suboptimal temperature incubation. The recovery is much less pronounced if the cells are irradiated in the absence of oxygen. The nutritional factors that favor recovery can be purified from several source materials by paper chromatography or alcohol extraction. These factors apparently consist of several constituents which, when used together, are highly effective, are not proteins, are water-soluble, and are acid- and heat-stable. Assay methods developed will detect less than 0.1 μg/ml of yeast extract.

This type of recovery has not been observed after ultraviolet irradiation; however, after exposure to short ultraviolet (< 3000 A), it is possible to demonstrate, (*a*) a dark recovery, and (*b*) a light recovery called photorecovery, which is brought about by the long ultraviolet and near-visible regions of the spectrum (Kelner). Photorecovery has not been demonstrated after x-irradiation. Although it may appear at first sight that all types of radiation produce the same final effect, the results of studies involving treatment after irradiation show that the x-ray and ultraviolet regions each produce distinct and different patterns of effects.

Mechanism of Regression of Mammary Cancers after Adrenalectomy

Charles Huggins and Thomas L-Y. Dao
University of Chicago

Widespread mammary cancers of humans often undergo extensive and prolonged regression after the adrenal glands have been removed; other types of breast cancer remain uninfluenced. The most responsive tumors are those where the neoplasm forms tiny luminated glands recognizable on cytologic examination; frequently secretion is observed in these acini. The syndrome of adrenal-responsive mammary cancer is associated with a considerable excretion of estrogen in the urine, even when the ovaries had been removed prior to the onset of the cancer or when the patient was postmenopausal and had no ovarian function; adrenalectomy under these circumstances abolishes the excretion of estrogen. The mechanism of regression after adrenalectomy consists in the elimination of hormones formed in the adrenal, of types similar to those normally found in the ovary. An essential parameter in the process is sufficient maturity of the neoplastic cells that they can respond to withdrawal of these hormones and consequently involute.

The Neutron-Electron Interaction

D. J. Hughes, *Brookhaven National Laboratory*

Slow neutrons, although uncharged, are expected to exhibit three distinct interactions with the electrons of an atom. The magnetic interaction with the spin magnetic moment of the electron is large and well understood, the relativistic interaction between the neutron moment and the electron charge is much smaller and has been only recently evaluated, and the electrostatic interaction between the electron and the meson cloud of the neutron is the smallest and least understood of the three. Because of the importance of this last interaction to meson theory, and in spite of its smallness, three neutron-optical experiments have been devised for its measurement. In all the methods the interference among neutron waves scattered from the electrons is used to isolate the electron interaction from the much larger nuclear scattering. At Argonne (Fermi, Marshall, Hamermesh, Ringo, Wattenberg), the angular variation of scattering from noble gases was used to identify the electronic

effect, and at Columbia (Rabi, Havens, Rainwater), the same information was obtained from the variation of scattering with neutron wavelength. Recent measurements at Brookhaven (Hughes, Harvey, Goldberg, Stafne) have utilized mirror reflection of neutrons to give a greatly increased sensitivity. Highly collimated neutrons were reflected at a grazing angle of a few minutes from the interface of polished bismuth and liquid oxygen. All measurements show that the meson cloud effect is small, the Brookhaven result giving an interaction well depth (for an e^2/mc^2 range) no more than 200 v, a result much less than is expected from current meson theory.

Effect of Photic Stimulation in Visual Pathways from Retina to Cortex

Donald B. Lindsley, *University of California, Los Angeles*

This exploratory study had two general purposes: To determine the role of central mechanisms in vision; and to form a background for interrelating neurophysiologic and psychologic data in experiments on human perception.

Electrical responses were recorded simultaneously from several sites in visual pathways and cortical areas in the cat during repetitive photic stimulation. Recording sites included retina, optic tract, lateral geniculate body, optic radiations, visual cortex I and II, and nonvisual cortex. Stimulus parameters involved light-dark ratio, intensity, wavelength, frequency, and duration of flash. Subcortical electrodes were positioned by the Horsley-Clarke technique. Recording sites were precisely localized by histologic study.

Extensive observations have been made in thirteen successful preparations. Three were under Nembutal or chlorolosane anesthesia; the remainder were unanesthetized, but decerebrated preparations.

The results permit differentiation of visual and nonvisual areas cortically and subcortically. The retina, optic tract, and lateral geniculate body respond discretely, with varying patterns, to frequencies of stimulation up to and over 100/sec, whereas specific areas of the visual cortex fail to follow the stimulus beyond about 40/sec. This suggests a possible mechanism of visual fusion. Interesting differential effects to monochromatic light have been obtained, with maximal response to yellow and blue-green and minimal or no response to red. Intensity, duration of flash, and light-dark ratio each produced modifications in subcortical and cortical responses. The significance of the results for visual theory and for further experimentation are discussed.

A General Theory of Convergence

E. J. McShane, *University of Virginia*

By a syntax we shall mean a system of f, X consisting of (a) a function f on a domain D_f, and (b) a nonempty family X of nonempty sets such that if X_1 and X_2 belong to the family X, there exists an X_3 in the family which is contained in X_1 and in X_2. The syntax f, X *converges into* a family Y of sets if to each Y of the family Y corresponds X in X such that when x is in X, $f(x)$ is in Y. The resulting theory of limits includes the theory of filters and Moore-Smith convergence in a straightforward manner, and therefore includes all the well-known special types of convergence. It leads to simple proofs of basic limit theorems in analysis and topology. The topological applications—for example, in characterizing compactness—are the same as those of the other theories.

Electron Interferometry

L. Marton, J. Arol Simpson, and J. A. Suddeth
National Bureau of Standards

An interferometer has been constructed which operates with electron beams and produces a system of fringes in the viewing instrument. The appearance of the fringes can be varied at will by changes in the (electron) optical path. Such changes can be introduced either by mechanical means (displacement of the optical elements) or by electromagnetic means (changing of the refractive index). Calculations of fringe spacings, based on light optical analogies, show good agreement with the observed spacings.

The instrument belongs in the category of "wide-beam" interferometers: beam-splitting is achieved by amplitude splitting as in the Mach-Zehnder-type instrument of light optics. In absence of "true" reflection for electrons, diffraction on thin crystal lamellae was chosen as the beam-splitting process. A peculiarity of this kind of beam-splitter is that it produces an "achromatic" instrument; that is, its fringe system is independent of the spectral composition of the radiation emerging from the source.

The production of a fringe system by such an instrument shows that the analogy between the physical optics of photons and of electrons is valid over a wider range of experiments than has been generally assumed. Further plans call for improvements in the performance of the instrument and its application to different problems in physics.

The Interpretation of the Kinetic Constants of Systems Envolving α-Chymotrypsin

Carl G. Niemann, *California Institute of Technology*

The α-chymotrypsin catalyzed hydrolysis of a number of simple synthetic specific substrates can, under certain circumstances, be described in terms of equation (1) where $K_s = (k_2 + k_3)/k_1$. Since this process can be considered

$$E_f + S_f \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_3} E_f + P_{1f} + P_{2f} \qquad (1)$$

to be dependent upon two factors—i.e., the affinity of the enzyme for a particular specific substrate and the susceptibility to subsequent reaction of the corresponding intermediate enzyme-substrate complex—it becomes desirable to be able to evaluate the dissociative constant of ES—i.e., k_2/k_1 from the experimentally determinable values of K_s and the so-called specific rate constant k_3. As this can be done only when $k_3 \ll k_2$, it is important to recognize those types of specific substrates wherein this situation prevails and those wherein it does not. On the basis of extended observations on the kinetics of hydrolysis of a variety of simple synthetic specific substrates and the behavior of enantiomorphic and structurally analogous competitive inhibitors, and on the basis of the pH dependency of the K_s and k_3 values of the specific substrate tyrosinhydroxamide, it can be shown that $K_s = k_3/k_1$ for a number of acylated α-amino acid hydrazides and amides and a representative α-amino acid hydroxamide, but that K_s is probably not equal to k_3/k_1 for the acylated α-amino acid hydroxamides, and is certainly not equal to k_3/k_1 for the majority of the acylated α-amino acid esters.

Dielectric Increments in Aqueous Solutions of Synthetic Polyelectrolytes

J. L. Oncley, H. M. Dintzis, and R. M. Fuoss
Harvard University and *Yale University*

Measurements of the dielectric constant and conductance of aqueous solutions of poly-4-vinyl-N-*n*-butyl pyridinium bromide have been made at 0° and 25° C over the frequency range from below 10,000 to 4,000,000 c/sec and the concentration range from 2.4 to 0.05 g/liter. The polyelectrolyte preparation used was a middle fraction with number average molecular weight of the order of 500,000.

Because of the polarization capacity resulting from the high conductance of these solutions (specific conductance from 320 to 6 μmhos/cm), and the wide dispersion region of this polymer, it has been difficult to obtain quantitative values for the dielectric increments of these solutions. The dielectric constant shows marked frequency dependence above 100,000 c/sec and surprisingly little concentration dependence. At the lowest concentrations and at frequencies below 100,000 c/sec, the polyelectrolyte yields dielectric increments of several hundred dielectric constant units/g/liter. These increments are 100–1000 times those observed for globular proteins, and amino acids and peptides.

Measurements of the increase in conductance at high frequencies are consistent with these high dielectric increments, and also indicate much heterogeneity in regard to relaxation times.

There are many points of similarity between these measurements and those of G. Jungner, I. Jungner, and L.-G. Allgen on the dielectric constants of aqueous solutions of sodium thymonucleate. Both materials show large deviations from the usual linear dependence of dielectric constant upon concentration above 0.05 g/liter, and a shift to smaller relaxation times as the concentration is increased. Dielectric increments and relaxation times are of the same order of magnitude as the higher molecular weight nucleic acid salts. The thymonucleate solutions show a more homogeneous behavior in regard to relaxation times, however, as might be expected in view of the heterogeneous nature of the preparations studied here.

Species Differences in Taste Sensitivity

Carl Pfaffmann, ***Brown University***

The sense of taste in three species, the rat, rabbit, and cat, was studied by recording the sensory nerve impulses from the tongue. The chorda tympani nerve in anesthetized animals was dissected free and placed upon wick electrodes connected to an amplifier and cathode-ray oscillograph recording unit.

In all species the nerve showed varying amounts of resting activity. This was most pronounced in the rabbit. Application of chemical solutions to the tongue produced a maintained asynchronous discharge of impulses. The discharge returned to the resting level when the tongue was rinsed. Thresholds ranged from low to high, in order, for quinine, hydrochloric acid, sodium chloride, and sucrose. In all species the acid and salt produced significantly more neural activity than did quinine or sucrose. The response to hydrochloric acid in the three species was very similar. Quinine gave relatively more response in the cat, whereas sucrose gave relatively more response in the rabbit and the rat. The more striking differences were noted in the relative effectiveness of salts. Whereas sodium chloride was much more effective than potassium chloride in the rat, this relation was reversed in the cat and rabbit. In the rabbit especially, potassium chloride was more effective than sodium chloride.

The results emphasize that any general theory of taste must take species differences into account.

Electron Distribution in Molecular Hydrogen

Norman F. Ramsey, ***Harvard University***

Due to the second order paramagnetism term in the theory of molecular diamagnetic susceptibility, measurements of the magnetic susceptibility of H_2 do not directly determine the mean square distance, $< r^2 >$, of an electron from the midpoint of the molecule. However, the second order paramagnetism term has been experimentally determined from molecular beam measurements of the rotational magnetic moment. When this result is combined with Havens precision values of the diamagnetic susceptibility of H_2, a value for $< r^2 >$ of $(0.7258 \pm 0.0022) \times 10^{-16}$cm^2 is obtained for H_2 molecules in the first rotational state. The error in this determination could be reduced by a factor of ten if there existed equally precise data on the susceptibility at a much different temperature. From molecular beam experiments, the dependence of the molecular diamagnetic susceptibility upon molecular orientation has been measured, and from this the quadrupole moment of the electron distribution has been inferred. When the quadrupole data is combined with the above value for $< r^2 >$ and when the z axis is taken along the internuclear line, the principal second moments of the electron distribution in molecular H_2 are found to be $< x^2 > = < y^2 > = (0.2144 \pm 0.0015) \times 10^{-16}$cm^2 and $< z^2 > = (0.2969 \pm 0.0022) \times 10^{-16}$cm^2.

Behavior Cycles in Man and Animals

Curt P. Richter, ***Johns Hopkins Hospital***

For the study of behavior cycles in man we need daily observations and records of behavior over long periods of time. Psychiatric clinics offer the best opportunity for obtaining such observations and records.

At the Phipps Psychiatric Clinic I have found records of patients who showed very regular cyclical changes in behavior, changes between normal and most abnormal behavior, between depression and elation, between stupor and excitement. The frequency of the cycles ranged from 2 to 40 days. For each patient the cycles had a definite frequency.

Little or nothing is known about the origin of these behavior cycles in man. We have attempted to throw light on their origin through studies on the experimental production of cycles in animals.

The rat lends itself best of all for such studies, since daily records can readily be made of its gross bodily activity (running in a revolving drum), food and water intake, body weight, and vaginal smears.

We have produced regular behavior cycles by interfering with the endocrine glands: a 30–40-day cycle by thyroidectomy or by thyroid injury through treatment with I^{131} or sulfamerazine; a 20-day cycle by parathyroidectomy; a 14-day cycle by pituitary stalk section; a 90-day cycle by removal of one ovary and all except a small remnant of the other ovary.

Cycles were produced in wild Norway rats by severe stress or by captivity.

This knowledge may be of help in the understanding of the origin of behavior cycles in man.

The Role of the Tricarboxylic Acid Cycle in Amino Acid Synthesis in *Escherichia coli*

R. B. Roberts and P. H. Abelson

Carnegie Institution of Washington, Washington, D. C.

The amino acid synthesis of *E. coli* growing with glucose as the principal energy source has been studied, using various C^{14}-labeled compounds. Under these conditions 35% of the total carbon assimilated is incorporated by way of the tricarboxylic acid cycle which leads to the synthesis of aspartic acid, glutamic acid, and the group of amino acids derived from them.

The rates of flow in the various branches of the cycle have been determined, using $C^{14}O_2$ as a tracer. In exponentially growing cultures the cycle produces 19 μmoles of aspartic acid and 16 μmoles of glutamic acid/min/g dry cells. Seventy per cent of the aspartic acid is derived from carbon that has just entered the cycle, and 30% from carbon that has passed around the cycle. This flow pattern predicts for other experiments precisely the distribution of C^{14} observed in aspartic acid and glutamic acid when $C^{14}H_2COOH$, $CH_2C^{14}OOH$, and C^{14} glucose are used as tracers.

The carbon efficiency of the cycle is high; only 25% of the total carbon entering the cycle is converted to CO_2. The net CO_2 output of the cycle accounts for only 2% of the total CO_2 produced from glucose.

It appears that the Krebs tricarboxylic acid cycle, which was formulated to describe oxidation in vertebrate tissue, also applies to *E. coli*. However, in these growing cells the cycle is important as a mechanism for amino acid synthesis but relatively unimportant in the oxidation of glucose.

Photon-stimulated Diffusion in Solids

Frederick Seitz, *University of Illinois*

Several decades of research on alkali halide crystals colored by the addition of an excess of alkali metal and by ionizing radiations have established beyond reasonable doubt that the centers producing coloration in the visible part of the spectrum (F-centers) are to be associated with halogen ions which have been replaced by electrons. If the crystals are irradiated with light lying in the absorption band associated with F-centers, in an appropriate range of temperature, some of the electrons are removed from F-centers and transferred to other F-centers, thereby producing F′-centers, which have 2 electrons instead of 1, and vacant halogen ion sites (negative-ion vacancies). Delbecq, Pringsheim, and Yuster have recently identified two new absorption bands, in the far ultraviolet at the edge of the fundamental absorption bands of the crystals, that are correlated with halogen-ion vacancies and with F-centers. These bands, termed the α and β bands, respectively, are now believed to be associated with absorption of light by the halogen ions in the vicinity of the centers and the production of excitons trapped at the centers. Very recently Martienssen has shown that the intensity of the α band can be diminished by irradiating the crystal with light absorbed in the α band. The quantum yield is low. This diminution has been observed at liquid nitrogen temperature where the rate of diffusion of the halogen-ion vacancies as a result of normal thermal fluctuations is presumed to be completely negligible. It seems necessary to assume that lattice vibrations of large amplitude, stimulated at the halogen-ion vacancies as a result of absorption of light quanta, promote diffusion of the vacancies and allow them to disappear or join clusters. This process could, in principle, occur even at the absolute zero of temperature and suggests a mechanism whereby other transport phenomena can be induced by radiation at low temperatures.

Theory of the Atomic Beam Resonance Method for Excited States

Robert Serber, *Columbia University*

An atomic beam resonance method for studying atoms in excited states has recently been described by Rabi. The atoms are raised to excited states by illuminating them with their resonance radiation, and transitions between these states are induced by a radiofrequency field before they drop back to the ground states. Denote the ground states by an index τ, the excited states by m; suppose that initially the atom is in the state $\tau=0$, and that the angular frequency of the radiofrequency field, ν, is nearly equal to ν_{21}, the frequency difference between two excited states $m=1$ and 2. A simple argument suffices to obtain the resonance formula for the relative probability, P_τ, that the atom will fall back to the state τ,

$$P_\tau=\frac{1}{\gamma}\left\{\sum_m \gamma_{m\tau}\,\sigma_{m0}+\frac{1}{2}\,(\gamma_{2\tau}-\gamma_{1\tau})(\sigma_{10}-\sigma_{20})\,\frac{|U_{21}|^2}{(\nu-\nu_{21})^2+\gamma^2+|U_{21}|^2}\right\}.$$

Here $\gamma_{m\tau}$ and σ_{m0} are the spontaneous and induced widths for transitions between the indicated states, $\gamma=\sum_\tau \gamma_{m\tau}$, and $\frac{1}{2}\hbar U_{21}$ is the matrix element of the interaction energy with the radiofrequency field.

A more systematic derivation of the intensity formula has now been carried out, which makes clear the various effects neglected in the simple derivation, and permits evaluation of these effects if greater precision is desired. Among the effects we may list the influence of the frequency spectrum of the resonance radiation, the induced widths of the levels due to the stimulated emission caused by the resonance radiation, the line shifts produced by the fields of the resonance and radiofrequency radiation, effects of the variation of matrix elements with frequency, antiresonance terms in the interactions of the resonant levels with the radiofrequency field and nonresonance interactions with other states, and the possibility of multiple emission and absorption of radiofrequency photons.

Problems of Gene Structure. II, Separation of R^r Elements (S) and (P) by Unequal Crossing Over

L. J. Stadler and M. G. Nuffer, *University of Missouri*

In cultures heterozygous for a heterochromatic appendage of chromosome 10 (designated K10), mutation of *R* is sometimes associated with crossing over. The compound *G* R^r: Cornell (*k*)/*g* R^s: Queens *K*, in a test of 70,140 ♀ gametes, yielded 12 seed color mutations of *R*, of which 5 were crossovers between *R* and *K*, and 7 were not. Standard crossover frequency for the R^r-*K* interval is about 1%.

Assuming the constitution (P) (S) for R^r: Cornell and (p) (S) for R^s: Queens, the crossovers would have to be unequal to cause loss of (S). However, this is not critical evidence for unequal crossing over, for with other assumptions of elementary constitution of the two alleles, the loss of seed color effect could be produced by equal crossing over.

The gene R^r: Cornell was transferred to the K10 chromosome, and mutation behavior studied in the compound $G\ R^r$: Cornell $(k)/g\ R^r$: Cornell K. Here crossovers resulting in loss of seed color or plant color effect must be unequal, whatever the elementary constitution assumed. Of the 13 seed color mutants identified among 74,056 ♀ gametes tested, 5 were crossovers between G and K and 8 were not. Of the 5 plant color mutants among 58,785 ♀ gametes tested, all were crossovers between G and K. Standard crossover frequency for the G-K interval is about 15%.

The frequency of "crossover-mutants" is similar in the 3 determinations (about 7/100,000 gametes). This frequency is superimposed upon a varying frequency of mutations independent of crossing over. In the homozygous R^r: Cornell culture studied this was about 13/100,000 gametes for seed color mutations and 0 for plant color mutations.

Thus the determiners designated (S) and (P) are physically separable genic elements, which are probably synaptically homologous. Their order with reference to G and K is G (P) (S) K.

Current Research on the Cosmical Abundances of the Elements

Otto Struve, *University of California, Berkeley*

Recent investigations at Berkeley have shown that the chemical compositions of binary star components, having identical masses, are the same to within less than about 20%, in terms of numbers of atoms. Similar conclusions, though less precise, have previously been obtained for stars in galactic clusters having identical luminosities. At the other extreme are systems composed of a normal star and of a planetlike satellite similar to Jupiter, which differ enormously in the relative abundances of hydrogen and other light elements. It is probable that intermediate systems with mass ratios of the order of 10:1 or of 100:1 may also show appreciable differences in the compositions of the atmospheres of the components.

These results are reviewed in the light of previous work on the relative abundances of hydrogen to metals in young stars of Population I and old stars of Population II. Attention is called to a remarkable contradiction between results obtained for yellow and red giants and dwarfs on the one hand, and blue pulsating stars on the other: The former seem to indicate a high abundance of hydrogen, whereas the latter definitely suggest a low atmospheric abundance of hydrogen.

The purpose of this paper is to demonstrate the importance of a cooperative plan for research, taking into account the conclusions of nuclear physicists, and coordinating these conclusions with the vast mass of scattered astronomical determinations. It is probable that processes other than nuclear ones are responsible for many, if not all, the observed differences in the present atmospheric compositions of the stars. However, there are a number of *indications* that nuclear processes may produce not only large-scale effects, such as the conversion of hydrogen into helium, but also occasional processes involving the production of heavy atoms.

The Origin of Soluble Substances on the Earth's Surface

Harold C. Urey, *University of Chicago*

Goldschmidt has explained the high abundance of certain elements—i.e., Cl, Br, B, and S—as due to their volatilization at high temperatures as the earth was formed. However, other elements should be as volatile or even much more volatile than these, and are not concentrated at the earth's surface. Hg and As are particularly volatile, F is about as volatile as Cl, and in a reducing atmosphere Cd and even Zn should be volatile. The distribution of elements does not agree with Goldschmidt's hypothesis. Compounds of Cl, Br, and B are soluble in water, whereas those of the other elements mentioned are not. Iodine should belong in this group, but the data are incomplete. Various hypotheses relative to the origin of this regularity are discussed. It is concluded that the outer 100 km or more of the earth accumulated at sufficiently low temperatures to permit liquid water at its surface. No satisfactory way for the inclusion of nitrogen in igneous rocks at high temperature is found, but its inclusion as ammonium salts from primitive oceans agrees with the published data exactly. S was present as H_2S in nonequilibrium amounts because of temporary high temperature processes (i.e., collisions) and slow reaction with ferrous oxide and silicates at the low prevailing temperature. Carbon was present as CH_4 in the primitive atmosphere, and complex organic compounds appeared before the earth was completely formed.

On a Theory of Conditional Equations in Finite Fields

H. S. Vandiver, *University of Texas*

Consider the congruence

$$x^m + ay^n + b \equiv 0 \pmod{p}, \qquad (1)$$

with a, b, m, and n given integers, p a given prime with $xyabmn \not\equiv 0 \pmod{p}$. This statement is equivalent to saying that the expression on the left must be exactly divisible by p, and we may examine the possible values of integers x and y that will bring this about. To attack the problem in general it seems convenient to take initially classes of congruences of the type (1), and first we may keep a, b, m, and n fixed and let p range over the set of primes. This particular problem has been extensively studied, and limits have been found for the number of possible sets (x, y) by Mordell and others. N. C. Ankeny and the writer have obtained results concerning the classes of congruences (1) when a, b, and p are fixed but $m = n$, with m ranging over the set of positive integers. The writer has also recently obtained some theorems concerning the class obtained when p ranges over the set of primes with a and b fixed and mn a multiple of $(p-1)$.

One generalization of (1) is obtained from an analogous equation in finite fields in lieu of a congruence. Another is obtained by increasing the number of unknowns as far as we please.

The Collective Model of the Nucleus

John A. Wheeler, *Princeton University*

An individual particle moving through the nuclear interior experiences at the nuclear surface a sharp change in potential, as a consequence of which a strong coupling is set up between the given particle and other nucleons. This coupling leads to the existence of collective modes of oscillation of the nucleus, in which the boundary undergoes displacements that are periodic in time (capillary oscillations). Starting from the idealization of perfect saturation of nuclear forces, one arrives at a picture—the

collective model of the nucleus—which unites many of the features of the independent particle picture and the liquid drop model. There is a close analogy with molecular physics. In the one case a given assignment of electrons to orbital states determines a characteristic potential energy curve or surface for the vibration of the diatomic or polyatomic molecules. In the other case, the state of the nucleons fixes the potential energy as a function of the parameters which describe the collective oscillations. Slipover from one surface to another near a point of contact is a mechanism fundamental for the exchange of energy between collective motion and individual particle excitation. The Franck-Condon principle has important consequences for the mechanism of typical nuclear processes. The collective model has important implications for the values of nuclear quadrupole moments, and for the rates of typical nuclear reactions.

Pulmonary Blood Flow at High Altitudes

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Western Reserve University School of Medicine

It is, of course, well known that the blood is incompletely oxygenated (anoxia) at high altitudes, owing to the low pO_2 of the atmosphere. Attention has recently been called to the fact that anoxia constricts pulmonary vessels. This could be interpreted as an impediment to pulmonary blood flow, resulting in transport of less hypoxic blood to the tissues.

Several types of rebreathing experiments were carried out on dogs to determine whether such a circulatory factor operates. In a first series, the effects of progressive anoxia were deduced from changes in pressure pulses recorded simultaneously from the aorta, left atrium, and pulmonary artery. The conclusion was drawn that both ventricles expel more blood per beat. Since the heart also accelerates, the cardiac output/min increases. This could not happen if pulmonary blood flow were reduced. In a second series, it was shown by use of a flowmeter that increased pulmonary blood flow averaged 26% during a degree of anoxia corresponding to that produced at an altitude of 19,000 ft. In a third series, it was shown that the augmented flow occurs despite the induction of augmented pulmonary vascular resistance; but the elevation of pulmonary pressure occasioned by greater right ventricular output physically overpowers this constriction action. In a fourth series, the opinion of some previous workers, that the site of increased resistance lies beyond the alveolar capillaries, was confirmed. Hence, oxygenation of blood in the alveoli would not be impaired. The conclusion is drawn that cardiac stimulation by anoxia even compensates to some extent for the decreased oxygen saturation of blood by transporting larger volumes to the tissues.

Suppression of Spontaneous Tumors of Mice through the Considered Use of Antimetabolites

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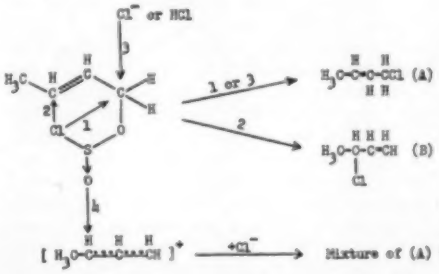
The study of the basis of selective action—i.e., of why a given chemical is poisonous to one living thing and harmless to another—has indicated that selective drugs can be predicted and realized through the application of existing biochemical and nutritional knowledge. Thus it can be shown that those cells which synthesize vitamin B_{12} and riboflavin are harmed by suitable antimetabolites of 1,2-dimethyl-4,5-diaminobenzene, the common precursor of these vitamins. Those cells which do not conduct these syntheses and therefore exhibit a nutritional need for these vitamins, are not affected. Because spontaneous mammary tumors of mice have been found to synthesize vitamin B_{12} in contrast to the inability of normal tissues to do likewise, the aforementioned antimetabolites of dimethyldiaminobenzene should selectively harm the neoplasms. Three of these antimetabolites have been shown to cause these spontaneous cancers to become smaller and occasionally to disappear. The substances are 1,2-dimethyl-4-amino-5-hydroxybenzene, 1,2-dichloro-4-(*p*-nitrobenzenesulfonylamido)-5-nitrobenzene, and 1,2-dimethyl-4-(*p*-carboxyphenylazo-)-5-hydroxybenzene. Not all individuals were benefited, and, in fact, only about 50% of animals exhibited regression or disappearance of the tumors. Furthermore, the regressions of the neoplasms were not permanent. All eventually began to grow again in 1–5 months. Studies were made in an effort to ascertain why the tumors became resistant to the drugs, and why all were not originally susceptible.

The Controlled Conversion of Allylic Alcohols into Chlorides with Thionyl Chloride

William G. Young, Fred Caserio, and David Brandon, Jr.
University of California, Los Angeles

The reaction of thionyl chloride with γ- and α-methylally alcohols has been studied under carefully controlled conditions to determine the effect of solvent, temperature, order of addition, and amines on the ratio of the various reaction paths 1, 2, 3, and 4 shown below for the γ methyl isomer.



These paths lead to the production of pure A, pure B, or a mixture of the two. With no solvent, 80% of the starting allylic alcohol is converted by Path 2 into the chloride of its allylic isomer. The addition of pyridine to the alcohol removes the possibility of Paths 1 and 2 and leads to the production of the same mixture of A and B from both allylic alcohols, presumably by Path 4. When ether is used as a solvent to tie up hydrogen chloride, each allylic alcohol is quantitatively converted into its isometric allylic chloride by Path 2. The introduction of a relatively much stronger base such as tributylamine apparently favors the quantitative operation by Path 3. If this controlled formation of known products can be extended to all allylic alcohols the procedures used should become invaluable in the study of natural products and in organic synthesis.

News and Notes

Rochester Conference on High-Energy Physics

THE Third Annual Rochester Conference on High Energy Physics was held at the University of Rochester December 18–20, 1952. Over one hundred representatives from 45 high-energy physics laboratories throughout the country attended, as well as representatives from eight foreign countries. The informal sessions centered on our increasing experimental and theoretical insight into the problems of pion production and pion nucleon scattering, and the new experimental information concerning the various classes of unstable particles. The conference, organized by R. E. Marshak, Chairman of the Rochester Physics Department, was jointly supported by the National Science Foundation and by the group of Rochester industries which had made possible the previous conferences in this series.

E. P. Wigner (Princeton) presided over the opening Thursday morning session on "Charge Independence and Saturation of Nuclear Forces," a subject about which he justly remarked "never has there been as much theoretical thinking done on a subject the experimental foundation of which is as inadequate as this one." Christy (CIT) showed that certain missing particle groups in the reactions $O^{16}(d,\alpha)N^{14}$ and $B^{10}(d,d')B^{10*}$ are evidence of the operation of charge independence selection rules, whereas the observed dipole transitions in O^{16} could be a violation of them; however, Kroll (Columbia) pointed out that in these systems, since they contain an equal number of neutrons and protons, the selection rules are already a consequence of the equality of n-n and p-p forces and do not require the full charge independence hypothesis. Blatt (Illinois) indicated that the equality of the n-p and p-p singlet effective ranges was the firmest evidence, although subject to some experimental uncertainty. Bethe (Cornell) remarked that the approximate equality of the scattering lengths is still suggestive, although not conclusive, because subject to shape and magnetic interaction corrections. Pais (Institute for Advanced Study) reviewed Lévy's charge independent model which is calculated from PS(PS) meson theory but contains two phenomenological constants (core radius and radiative correction) in addition to the coupling constant. Jastrow (Berkeley) has shown that the fit this model gives to the low-energy data is extremely insensitive to the radiative corrections, provided that compensating adjustments are made in the other parameters. As Wick (Carnegie Tech) pointed out, the attempted extension of this model to explain the 18 and 32 Mev p-p scattering data is inconclusive because of the use of Born approximation for the higher phases. Feldman (Rochester) indicated that the charge independence hypothesis requires the 90° n-p scattering cross section to be greater than one-quarter the corresponding p-p cross section, which has not yet been proved experimentally at high energies. Weisskopf (MIT) reported on calculations of Drell and Huang, showing that inclusion of three-body forces analogous to the two-body forces used by Lévy leads to approximately the correct density and nucleon energy in infinite nuclear matter.

During the Thursday afternoon session, presided over by E. Fermi (Chicago), H. Anderson (Chicago) presented data obtained by Hildebrand showing that the angular distribution of the reaction $n + p \rightarrow \pi^0 + d$ coincides with that for $p + p \rightarrow \pi^+ + d$, as required by charge independence. Van Hove (Institute for Advanced Study) discussed the general restrictions charge independence places on pion production. Experiments on charged and neutral photomeson production in hydrogen were described by Goldschmidt-Clermont (MIT), Silverman (Cornell), Goldwasser (Illinois), Osborne (MIT) and Wilson (Cornell), and Bacher (CIT) reported on the π^0 measurements up to 450 Mev, where the cross section at 90° is down by a factor of four from the peak value at 315 Mev. Fermi presented improved measurements of π^- scattering in hydrogen leading to new high-energy pion-nucleon phase shifts. Barnes (Rochester) reported that the π^+ and π^- total cross sections in hydrogen are practically equal ($\simeq 20$ mb) at 37 Mev, and Tinlot (Rochester) stated that the charge exchange scattering cross section is 5 ± 2 mb at the same energy.

With C. D. Anderson (CIT) as chairman, neutral V particle data were presented Friday morning. Peyrou (MIT) has definitely established the coplanarity of the $V^0{}_1$ decay using a multiplate cloud chamber and he finds $Q = 37$ Mev and a lifetime of $3.5 \pm 1.5 \times 10^{-10}$ sec. The $V^0{}_1$'s are apparently not produced in pairs, but a large fraction (possibly all) of the $V^0{}_2$'s could be accompanied by $V^0{}_1$'s. Leighton (CIT) finds a $V^0{}_1$ lifetime of $2.5 \pm 0.7 \times 10^{-10}$ sec. He has two or three cases of Q values definitely greater than 37 Mev, and three or four cases of $V^0{}_2 \rightarrow K^- + \pi^+$, where K^- is definitely heavier than a π meson but could be a negative proton. Thompson (Indiana) has five cases where the mass of the positive particle is definitely less massive than a proton. He also presented a method of plotting the data directly observed which should do much to resolve the existing uncertainties if applied to all data.

On Friday afternoon, J. R. Oppenheimer (Institute for Advanced Study) presided over a session on the "superheavy mesons" and the theoretical aspects of the pion problem. Perkins (Bristol) presented the evidence for two decay schemes for the K particles (masses 1000 to 1500 m_e), namely $K \rightarrow \mu + 2\nu$ since the μ meson energy is not unique, and $\chi \rightarrow \pi + (?)^0$ with a π meson energy of 115 ± 10 Mev. The rate of production of K particles relative to π's seems to increase with energy, as would be expected. In a critical

survey of the K particle data, LePrince-Ringuet (Paris) concluded that, whereas the upper limit of the energy spectrum of μ mesons from K decays is uncertain, there are at least four certain μ daughters and two certain π daughters of K particles. Amaldi (Rome) surveyed the data on τ mesons and concluded that, although the process $\tau \rightarrow \pi + 2\mu$ cannot be excluded with certainty, the $\tau \rightarrow 3\pi$ decay scheme is very probably correct. During the second part of the session, Feld (MIT) discussed the phenomenological connection between the photoproduction of pions and pion-nucleon scattering. Chew (Illinois) has obtained agreement with the p-wave pion scattering data in a theory using an arbitrary cutoff on relativistic momenta, by taking into account correctly all successive processes in which only zero, one, or two mesons are present in the field at a time. Dyson (Cornell) has used the same Daneoff approach to derive an integral equation for the pion-nucleon system that takes the relativistic properties of the nucleons seriously. When a variational principle is used to calculate the phase shifts, the results agree with those of Chew, but more exact numerical results demonstrate extreme sensitivity of the phase shifts to the high-energy part of the wave function, in contradiction to Chew's basic postulate. For the $I=3/2$ (I is the isotopic spin) p states, agreement with experiment is obtained with $G^2/4\pi = 14$ (the only parameter in the theory), but self-energy divergences have not been separated unambiguously from the $I=\frac{1}{2}$ equations. The s state results confirm those of Drell and Henley, giving essentially hard sphere scattering at the proton Compton wavelength, in disagreement with experiment. The experiments are therefore very interesting in showing the existence of a long range force between pion and nucleon. Qualitatively and phenomenologically the inclusion of the meson-meson interaction would work in the direction of explaining the experiments, but quantitatively the strength of the interaction as indicated by the theory is so strong as to preclude exact treatment at this time.

Saturday morning was a continuation of the Friday afternoon session. Fermi presented the new phase shifts that had just been calculated with the Los Alamos computer on the basis of his new experimental values for the pion-nucleon scattering. The alternative Yang (Institute) set of phase shifts does not represent the data so well as his choice, but is still well within experimental error. The smooth, rapid rise of the $I=3/2$ s phase shift is no longer so striking, but is still suggestive of Marshak's hard core plus attractive-tail phenomenological potential, or the expected result of including the meson-meson interaction in Dyson's equation. Marshak pointed out that the sign of the s phase shift at low energy could be unambiguously determined by measuring the coulomb-nuclear interference. Bethe indicated that the sign of the high-energy phase shifts could be inferred from the measured attractive potential scattering in carbon, assuming that this is predominantly p-wave scattering; further, the interference term in photomeson production favors the Fermi rather than the Yang type phase shifts, if a particular model is used for the photoeffect. Leighton (CIT) presented the first evidence for a charged analog of the $V^0{}_1$ particle. Rossi (MIT) showed that at least some S and charged V mesons observed in a multiplate cloud chamber are the same, and that several of them are probably identical with the χ-mesons observed in emulsions. Shapiro (NRL) has two directly produced $\kappa \rightarrow \mu + ?$ mesons, and two cases that can be interpreted as $\zeta^{\pm} \rightarrow \pi^{\pm} + (\pi^0\ ?)$ with 40 Kev $< Q <$ 6 Mev and a lifetime of about 10^{-11} second. Perkins presented two similar cases, but feels a statistical survey is needed for positive identification.

Saturday afternoon was devoted to separate experimental and theoretical sessions. H. A. Bethe presided over the theoretical session at which Low (Illinois) outlined a program for a covariant calculation of pion-nucleon scattering. Watson (Indiana) indicated another approach to the problem, using Goldberger's formal algebraic methods to separate out sequentially a series of scattering problems in which the virtual intermediate mesons are scattered in the previously calculated equivalent potential. This series is more likely to converge than the usual perturbation expansion, but whether it is renormalizable is an open question. Dyson discussed in more detail the integral equation he had already presented, and Bethe gave a differential equation that approximates it. In particular, Bethe has shown that the equation predicts an antiresonance following closely after the resonance, much as is found in the CIT π^0 photoproduction data, though the exact connection is not clear. Wentzel (Chicago) showed that the strong coupling approach can also lead to qualitative agreement with experiment, but that corrections to Lévy's potential are likely to be quite large. In the experimental session, with B. Rossi in the chair, Rainwater (Columbia) discussed x-rays from μ mesic atoms, and Platt (Rochester), x-rays from π-mesic atoms. The former give a precise measurement of the radii of heavy nuclei, and the latter measure the mesic interaction in p states, although as discussed by Roberts (Rochester), they exhibit peculiar "molecular" effects in hydrogenous materials. Direct production of electron pairs in π^0 decay and the π^0 lifetime were discussed by Schein (Chicago), Ritson (Rochester), Perkins, A. Sachs (Columbia), and Fermi. Schein also presented evidence of possible $V^0{}_1$ production by π mesons from the Chicago cyclotron, and Segré (Berkeley) had two similar events from Illinois, but Fermi reported a failure to detect $V^0{}_1$'s by a different method. Perkins presented two cases that look like the direct production of μ mesons, but indicated that there is no longer any direct evidence for the existence of ζ^0. Walker (Rochester) finds that less than 0.25% of the shower particles from carbon consists of correlated pairs. Reynolds (Princeton), Lederman (Columbia), and Shutt (Brook-

haven) discussed data on π and μ interactions in various elements.

A comprehensive report of the proceedings of this conference has been prepared by three Rochester staff members, H. P. Noyes, M. Camac, and W. D. Walker, and is available through Interscience Publishers (New York).

H. P. Noyes

University of Rochester
Rochester, New York

Scientists in the News

Edward M. Corson, senior scientist in mathematical physics at the New York University Institute for Mathematics, has been appointed adjunct professor in theoretical physics in the School of Graduate Studies.

Three scientists in Great Britain and Ireland have recently received new appointments. **C. D. Darlington,** director of the John Innes Horticultural Institution, will succeed **T. G. B. Osborn,** who is retiring as Sherardian professor of botany in the University of Oxford. **Donald Cecil Pack,** lecturer in mathematics in the University of Manchester, has been appointed to the chair of mathematics in the Royal Technical College, Glasgow. During 1951–52, Dr. Pack was a visiting research associate professor at the University of Maryland. **T. E. Nevin** has succeeded the late **J. J. Nolan** in the chair of experimental physics in University College, Dublin.

Gustav Egloff, director of research of Universal Oil Products Company, has been elected an honorary member of the Association Française des Techniciens du Pétrole, Paris.

Haven Emerson and **Irving S. Wright** have received awards from the American Heart Association in recognition of scientific contributions to the association's heart program. Dr. Emerson received a Gold Heart Award and Dr. Wright a Distinguished Service Silver Medallion.

Ernst Jokl has been appointed chief of the Department of Clinical Psychology at the Valley Forge Heart Institute and Hospital, Fairview Village, Pa. Dr. Jokl has conducted extensive investigations into the normal and pathological physiology of exercise.

Celestino Kalinowski of the Department of Zoology, Chicago Natural History Museum, has left on an expedition to collect mammals and birds in the mountains of south central Peru. The present expedition, which will take a year, supplements a series of Peruvian mammal surveys by other collectors for the museum, begun in 1912.

I. F. Kinnard, engineering manager of the Meter and Instrument Department, General Electric Company, West Lynn, Mass., has been awarded the 1952 Lamme Gold Medal, by the American Institute of Electrical Engineers, for design and developments in instrumentation and measurements.

Roger A. Lewis, formerly of Yale University, has been appointed visiting professor of pharmacology at the Seth G. S. Medical College, Bombay, India. This post is under the auspices of the Division of Education and Training Services, World Health Organization.

Catharine Macfarlane, research professor of gynecology, Woman's Medical College, Philadelphia, was selected to receive the first annual Silberman Memorial Group Award for her work in cancer detection.

Elizabeth Gregory McGill, consultant aeronautical engineer in Toronto, has been chosen by the Society of Women Engineers to receive their 1953 Award for Meritorious Contribution to Engineering. Miss McGill was honored for her work in airplane engineering and production during and after World War II.

Frank W. Newell, ophthalmology associate at Northwestern University Medical School, has been appointed associate professor of ophthalmology at the University of Chicago, effective May 1.

Howard W. Odum, head of the Department of Sociology and Anthropology, University of North Carolina, has been granted the fifth annual O. Max Gardner Award by the trustees of the university, in recognition of his contribution to the development of American sociology.

Bernard G. Peters, head of the Department of Nematology at the Rothamsted Experimental Station, Harpenden, England, has joined the staff of the Connecticut Agricultural Experiment Station for three months, as a special adviser and consultant. Dr. Peters will give most of his attention to the problem of the tobacco cyst nematode, a new species of parasitic worms discovered by **Benjamin F. Lownsbery,** plant pathologist at the station.

John L. Rich, professor of geology, University of Cincinnati, has been named an honorary member of Sigma Gamma Epsilon, national earth sciences honorary fraternity. Dr. Rich is the seventh person awarded an honorary membership in 40 years, and was cited for his work in economic geology.

Jose Romero, chemical engineer of the Agriculture Experiment Station, Tingo, Lima, Peru, was a recent visitor at the U. S. Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory, Philadelphia.

Will H. Shearon, Jr., has been appointed managing editor of the American Chemical Society monthly, *Industrial and Engineering Chemistry.* Mr. Shearon has been an associate editor of both the monthly magazine and the weekly, *Chemical and Engineering News,* and has been in charge of the society's Houston editorial office since its opening in 1946.

Courtney Craig Smith, American secretary of Rhodes Trustees, has been elected president of Swarthmore College, effective Sept. 1. Dr. Smith was a Rhodes Scholar in 1938–39 at Merton College, Oxford, and obtained his Ph.D. at Harvard. He has served as assistant professor of English, and as national director of the Woodrow Wilson Fellowship program, at Princeton. At 36, he becomes one of the youngest college presidents in the country. He succeeds **John W. Nason,** who resigned to become president of the American Foreign Policy Association (SCIENCE, 116, 702).

Robert G. Tischer, formerly professor of food technology at Iowa State College, has been named director of Food Laboratories for the Armed Forces Quartermaster Food and Container Institute.

James C. White, assistant professor of surgery, Harvard Medical School, will give the annual Hughlings Jackson Memorial Lecture at the Montreal Neurological Institute on May 13, at 5:00 P.M. His subject will be "Pain Conduction in Man: Studies on its Transmission in Spinal Cord and Visceral Plexuses."

Gene M. Wild has joined the Antibiotics Manufacturing and Development Division of Eli Lilly and Company as a biochemist. Dr. Wild previously taught chemistry at Iowa State College, where he also received his Ph.D. early this year.

John Xan, head of the department of chemistry, Howard College, has been chosen by the Northeastern Section of the American Chemical Society to receive the James Flack Norris Award for achievement in the teaching of chemistry.

Grants and Fellowships

The **Damon Runyon Memorial Fund for Cancer Research** has made research grants to: Duke University, $37,000, to support a continuing project by Marcus E. Hobbs, for a study of "The Properties on Some Smoke Aerosols"; the University of Cincinnati, $9700 for a project, "Cytologic Diagnosis of Carcinoma of Digestive Tract," under the direction of Leon Schiff; the Montreal Cancer Institute, $5000, for a study of "Relative Distribution of Mononucleotides in Nucleic Acids of Rat Liver during Preneoplastic and Malignant Hepatoma Stage," under Antonio Cantero; Providence College, $1550, for "Metabolism of C-14 Labeled Cholesterol and Iodine Metabolism," under Frederick C. Hickey; and Immaculata College, at Immaculata, Pa., $1500, for the purchase of a research phase microscope for the continuance of a project, "The Mechanism of Action of Spleen Extract on Fatty Acid Metabolism of Normal and Tumor Tissues." Fellowship grants include an allocation of $4100 to Chiyeko Okawa, of Tokyo, to bring her to the Oak Ridge Institute of Nuclear Studies to do research on "Bone Marrow Physiology," under the direction of Marshall Brucer, chairman of the medical division at Oak Ridge. Other fellowships were granted to Gaston De Lamirande, $4800, and to Roger Daoust, $4500, both of the Montreal Cancer Institute; to Zacharias Kominos, of the New England Center Hospital, Boston, $4200; to Celia White Tabor, of George Washington University, Washington, D. C., a supplementary allocation; and to Elizabeth Pillers at the University of Cambridge, England, $3000.

The **Mount Desert Island Biological Laboratory,** Salisbury Cove, Me., announces receipt of a three year grand awarded by the American Cyanamid Co. (Lederle Laboratories Division). Each year $500 will be available for general support of the summer program which features basic research in the fields of renal physiology and electrolyte balance, and tissue culture.

The **Union Carbide Educational Fund** will inaugurate a new undergraduate scholarship program this year. About 400 scholarships will be awarded in 24 selected colleges and universities at an annual cost of around $500,000. Applicants for the four-year full-tuition awards (plus allowances for books and required fees) must satisfy the college's scholarship requirements and must be interested in careers in business. The fund will match each scholarship with a $600 annual grant to the institution.

Meetings and Elections

The Summer General Meeting of the **American Institute of Electrical Engineers,** Atlantic City, June 15–19, is being arranged by the Philadelphia Section of the institute, which will celebrate its 50th anniversary. A special effort is being made by the committee to interest student engineers, and arrangements have been made to have at least 40 from various engineering schools attend the meeting as guests of the Philadelphia Section. Technical sessions will be devoted to electronics, computers, facsimile, electrical techniques in medicine and biology, television, management, broadcasting, land transportation, magnetic recording, communications, power generation, power transmission and distribution, basic science and other fields of electrical engineering and the allied arts.

The annual foray and business meeting of the **Central States Section of the Botanical Society of America** will be held in the Black Hills at Frank Troxell's Guest Ranch, Nemo, S. D., June 22–24. Participants will assemble June 21. The program includes field excursions to several of the interesting forest, sagebrush, marsh, and semidesert locales, from altitudes of 7242 ft at Harney Peak to 3259 ft at Rapid City. All are welcome to attend. Queries may be directed to the chairman of the section, John Winter, Department of Botany, University of South Dakota, Vermillion.

The Mathematics Department of the **University of Michigan** is sponsoring a conference on functions of a complex variable, with emphasis on topological methods. The conference will run for approximately

two weeks, beginning June 17. The program will consist of a group of invited addresses and of sessions for contributed papers of 20 minutes. Among those who will present longer addresses are L. V. Ahlfors, L. Bers, A. Beurling, S. Bochner, S. Kakutani, C. Loewner, M. Morse, Z. Nehari, R. Nevanlinna, M. Ohtsuka, P. Rosenbloom, H. L. Royden, L. Sario, D. C. Spencer, and G. T. Whyburn. Anyone interested in presenting a contributed paper is requested to send an abstract to W. Kaplan, 274 West Engineering Building, Ann Arbor, Mich.

Miscellaneous

The **American Museum of Natural History** has begun work on a unique series of exhibition halls devoted to the study of man. John D. Rockefeller, 3rd, a trustee, through a gift of approximately $95,000 has made possible the preparation of a Hall of the Biology of Man. The first in a series of five to be devoted to the study of man, the new hall will initiate a comprehensive, three-dimensional interpretation of modern anthropological research, which views man as an integral part of the world around him rather than as something separate and isolated from his environment. To be planned and executed under the supervision of Harry L. Shapiro, chairman of the museum's Department of Anthropology, the new hall will be concerned with human evolution and biology and the relation of man to his environment, including the effect of nutrition, the mobilization of the organism against disease, and disease vectors. Later halls will deal with man's behavior, social organization, and cultural history, with the fifth hall to be devoted specifically to American culture. The exhibits to be created with the Rockefeller gift will be divided into three parts to show the evolution of man from the lower forms, the physical structure and workings of the human organism, and the group aspects of human life. Models, demonstrations, and new exhibition techniques will be used to present an integrated view of the various factors contributing to the physical make-up of man as he is today.

The **Canadian Ministry of Health and Welfare** has announced a flying public health expedition under the Indian Health Services, to carry out an extensive x-ray survey for tuberculosis among the Eskimos along the shores of the western Arctic and Arctic islands. The group, headed by L. Christensen, Indian Health Service doctor at Aklavik, N. W. T., will diagnose tuberculosis among the native population and arrange hospital care.

The **Commonwealth Scientific and Industrial Research Organization,** Australia, will make a survey to assess the agricultural potential of the various regions of Papua and New Guinea, in collaboration with the Department of Territories. This project follows the success of similar survey work in the Darwin-Katherine region, the Barkly Tableland, the Kimberleys, and other areas of northern Australia. The survey party will progressively map the country, classify the land according to its inherent qualities, describe its permanent characteristics, and assess its possibilities for agricultural development. The CSIRO team, under the direction of C. S. Christian, will receive cooperation from the RAAF Photographic Unit, which has been asked to make an aerial survey of terrain to be covered by the land party. Use will be made of aerial reconnaissance to select areas for detailed examination.

The Polish People's Republic has proclaimed 1953 **"Copernicus Year,"** and meetings and conferences are now under way in commemoration of the Polish astronomer. The 400th anniversary of the death of Nicolaus Copernicus (Mikolaj Kopernik) occurred on May 24, 1943, during the Nazi occupation of Poland. For obvious reasons the anniversary could not be celebrated at that time by Polish scientists or the Polish community. Now, a decade later, Polish science headed by the newly organized Polish Academy of Sciences has made plans to mark the anniversary. Among the events announced are: The Polish Association of Astronomers is completing arrangements for a conference of Polish and foreign astronomers. The meeting will take place in Krakow, at whose Jagiellonian University Copernicus received his training in mathematics and astronomy. Also scheduled in Krakow is the opening of an extensive exhibition under the title "Nicolaus Copernicus and the Epoch of the Renaissance." During 1953 a new and definitive volume from Copernicus' chief work, *De Revolutionibus Orbium Coelestium*, Book VI, will be published in Latin and Polish, with the editors making use of a Copernicus manuscript found about a century ago in a private library in Prague. Also being prepared by the State Science Publishing House is a new translation from the Italian of the *Dialogues* of Galileo. Other publishing ventures include a new edition of Copernicus' writings on economics, as well as an illustrated album on his life and work.

The Committee on the Survey of Food and Nutrition Research of the Food and Nutrition Board of the **National Research Council** reports excellent progress on the Third Survey of Food and Nutrition Research in the United States. About 3000 research projects have been listed to date. July 1 has been set as the deadline for receipt of information. In the forthcoming publication, the project titles will be arranged in 11 sections: Nutritional Requirements; Digestion and Metabolism; Nutritional Deficiencies; Nutrition Surveys; Methodology Pertaining to Nutrients; Enzyme and Hormone Chemistry; Food Composition; Factors Affecting Nutritive Value; Microbiology; Food Acceptance; Nutrition Education. A register of workers in this field, a list of organizations conducting or supporting the research, and a subject index will be included. A new feature will be the inclusion of suggested food and nutrition research projects in areas where further work is indicated.

Technical Papers

Respiration of the Parts of the Hybrid Gastrula *Rana pipiens* × *R. sylvatica*[1]

L. C. Sze[2]

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The general development of hybrid eggs obtained from the cross *R. pipiens* × *R. sylvatica* has been thoroughly studied by Moore (*1, 2*). He showed first of all that the hybrid eggs are blocked in most cases at a stage when a distinct dorsal lip is formed—that is, at stage 10 of Shumway (*3*)—and second, that the competence of the ectoderm and the inductive ability of the dorsal lip are generally weak in comparison with those of eggs from the cross *R. pipiens* × *R. pipiens*. The latter fact is especially interesting, since it suggests that the effect of hybridization may be a general disturbance of the eggs.

Barth (*4*) has found that the increase in respiration of hybrid eggs is also blocked beyond stage 10. The eggs continue to respire at the same rate as at the time when respiration is blocked. He has concluded that "not only does the dorsal lip metabolism remain at the gastrula rate, but all of the cells appear to continue to respire at this rate." Since the general respira- with those of eggs from the cross *R. pipiens* × *R. pipiens*) has already been studied by Sze (*5*), it was of interest to see whether the respiratory pattern of the hybrid gastrula is similar to that of the normal one.

Four regions of the hybrid gastrula, corresponding, respectively, to 1, 2, 3, and 4 in Fig. 1, were measured by the Cartesian diver technique. The results are given in Table 1. The average respiratory rates of regions 1, 2, 3, and 4 are 1.92, 2.25, 2.27, and 1.56×10^{-4} µl/µg/hr, with respect to dry weight, respectively. There is an apparent animal pole–vegetal pole respiratory gradient. Moreover, the dorsal lip in-

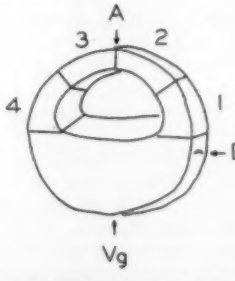

FIG. 1. Diagram showing the parts of the hybrid gastrula used in the measurements of the oxygen uptake. *A* = animal pole; *Vg* = vegetal pole; *D* = dorsal lip.

TABLE 1

RESPIRATION OF THE PARTS OF THE HYBRID GASTRULA, *Rana pipiens* × *Rana sylvatica*

Egg No.	Regions			
	1	2	3	4
1	1.71	1.48	1.96	1.46
2	1.57	2.57	2.36	1.41
3	2.27	2.77	2.74	1.81
4	2.04	2.15	2.23	1.60
5	2.00	2.26	2.08	1.51
Mean	1.92	2.25	2.27	1.56

Rate: $\times 10^{-4}$ µl/µg dry wt/hr.

variably has a higher respiration on the basis of dry weight than the ventral lip. When we compare the present data with data from the normal eggs of the same season as reported by Sze (*5*), we notice that the activities of the various regions of the hybrid eggs

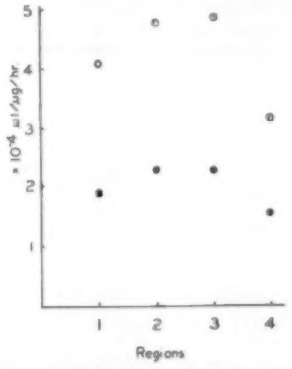

FIG. 2. Diagram showing the respiratory rates of the parts of the normal and hybrid gastrula. Hollow circles = normal; solid circles = hybrid.

are approximately half those in the corresponding regions of the normal eggs when their respiratory rates are expressed in terms of dry weight (Fig. 2). This indicates that the respiratory block in the hybrid embryo is not localized. Thus, the hybridization disturbs the respiration equally in every region of the egg.

It has been mentioned that the various regions of the hybrid eggs at stage 10 respire at only half the rate of the corresponding regions of the normal eggs taken at the same stage (on the same reference standard). The development of the hybrid eggs is slower, however, than that of the normal eggs. Usually, by the time the hybrid eggs reach stage 10, the normal eggs are already at about stage 11 of Shumway. Consequently, the above comparison is made on the basis of developmental stage. If we want to compare the relative rates of respiration of the parts of these two

[1] This work was supported by a research grant from Committee on Growth acting for the American Cancer Society and administered by L. G. Barth.

[2] Present address: The Creedmoor Institute for Psychobiologic Studies, Queens Village 8, New York.

groups of eggs on the absolute time scale, the normal eggs should be dissected at stage 10, and cultivated until the hybrid eggs of the same clutch are ready, and then measured simultaneously. One experiment has been carried out with region 1 as a test. This region of the normal egg was isolated first and cultivated under the same condition as the hybrid eggs. After the hybrid eggs reached stage 10, the corresponding region of the hybrid gastrula was dissected out. When the healing of the hybrid explant was complete, both the normal and the hybrid explants were measured simultaneously. The rates of the normal and the hybrid explants were, respectively, 4.17 and 1.60×10^{-4} μl/μg/hr with respect to dry weight. The normal explant has a respiratory activity 2.6 times greater than the hybrid one.

The results of the experiments suggest that the effect of the *R. sylvatica* genome on respiration is widespread. There is no localized effect; that is, all cells are apparently affected similarly, since the general respiratory pattern of the hybrid gastrula remains the same as that of the normal gastrula, the only difference between these two kinds of eggs lying in the magnitude of the respiratory activity. These results are in agreement with the conclusion of Barth (*4*) and the results from experimental embryological studies of Moore (*1, 2*).

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Liquid Scintillation Counting of Tritium-labeled Water and Organic Compounds[1]

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The liquid solution scintillator is assuming an increasingly important role for homogeneous counting of C^{14} compounds. With such compounds as steroids, fatty acids, etc., which have little quenching action on the scintillation system, relatively large samples may be counted with high experimentally realizable efficiency (40–60%). The high efficiency, ease of operation, and the large range in sample size provide ample reason for establishing liquid scintillation counting as the method of choice in many biological experiments utilizing C^{14}. Solutions that have been employed for scintillation counting include *p*-terphenyl in toluene (*1*), 2,5-diphenyloxazole in toluene (*2*), and *p*-terphenyl in various mixtures of dioxane and water (*3*).

Instrumentation problems associated with liquid solution scintillation counting of low energy β-particles have been partly resolved by coincidence circuitry (*1, 2*) and refrigeration of photomultiplier tubes in order to lower the portion of the background counting rate that is due to dark current. The upper level discriminator operating in anticoincidence (*2*) has proved useful for rejecting high amplitude background pulses and improving the counting rate ratio of sample to background.

The considerably lower energy β-spectrum of H^3 relative to C^{14} indicates the probability of a correspondingly greater difficulty in realizing satisfactory counting conditions for tritium. The observation that tritium-labeled hexestrol (*4*) could be counted with low efficiency in the C^{14} scintillation system (*2*) suggested further investigation of this type of tritium counting.

Using the fast coincidence instrument designed for C^{14} scintillation counting, various tritium-labeled steroids and fatty acids were counted, and the counting efficiency was estimated by assay of the water obtained on combustion. A vibrating reed electrometer was used to compare the water with a standard tritium water sample (*5*). In addition, it was found possible to count tritium water directly with about the same sensitivity as with the electrometer, and with considerably greater rapidity and convenience.

2,5-Diphenyloxazole was employed as the solute with toluene, dioxane, and xylene as the major solvents. The standard practice was to use 100 mg solute in a total volume of 30 ml solution. Miscibility of tritium water with toluene or xylene was achieved by addition of absolute ethanol.

Contamination difficulties were minimized by use of Pyrex weighing bottles (45 mm in diam by 65 mm) as sample containers. These can be swiftly inserted into, and removed from, the area between the photomultiplier cathodes, thus permitting samples to be changed without warming of the tubes. The sample holders also may be easily cleaned or discarded when significantly contaminated.

Coincidence counting efficiencies reported here were accompanied by backgrounds of 100–200 cpm. Efficiencies from either one of the single tubes were 2–4 times higher than those from the two tubes operated in coincidence, but the backgrounds were of the order of 10,000–100,000 cpm.

Results obtained with a few sterols dissolved in toluene are given in Table 1. Samples ranging in size from fractions of a milligram to a gram may be counted with the same efficiency, the upper limit of sample size being conditioned only by the solubility of the compound. Although certain organic compounds exhibit a quenching effect, none of those reported in Table 1 showed perceptible quenching in the concentrations reported.

The counting data obtained for tritium water are presented in Fig. 1 and Table 2. The highest efficiency was realized with 0.01 ml water, 0.19 ml absolute

[1] Work done under the auspices of the Atomic Energy Commission.

[2] The authors wish to acknowledge the technical assistance of Betty Rogers, Kenneth C. Kohr, and Robert W. Merwin, Jr.

TABLE 1

SCINTILLATION COUNTING DATA FOR TRITIUM-LABELED STEROLS IN TOLUENE SOLUTION

Tritium-labeled compound	Mg assayed	Mg inert form added	Cpm	Cpm/mg of labeled compound	Ion chamber results (μc/mg)*	Efficiency of scintillation counting (%)
Cholesterol-6,25-T_2	6.7	0	29,000	4,329	0.0315	6.41
	0.266	13.03	1,270	4,775		
	0.1037	999.9	463	4,340		
Cholestanol-5,6-T_2	0.064	31.93	4,042	63,100	0.442	6.44
Sitosterol-T	5.6	0	52,294	9,695	0.068	6.48
	0.0474	23.65	454	9,580		
	0.0167	167	168	10,060		
Δ^7-Cholestenol-5,6-T_2 (Lathosterol)	0 5	5.0	45,550	91,100	—	—

* Each sterol was diluted with the inert form to a specific activity of 0.02–0.08 μc/mg, burned in a combustion tube, and the resultant water assayed in a vibrating reed electrometer.

ethanol, and 29.8 ml toluene. The decrease in efficiency with increasing amounts of water is due to the dilution of the effective solvent; the decrease at small concentrations is apparently due to adsorption of the tritium water on the glass. The latter effect has not been observed in tritium sterol or in C^{14} counting. A convenient procedure for preparing tritium water samples for counting is to add absolute alcohol to the sample to give either 90% or 95% alcohol. An aliquot of the dilute alcohol is then added to a solution of 100 mg of 2,5-diphenyloxazole in sufficient toluene or xylene to give a total volume of 30 ml.

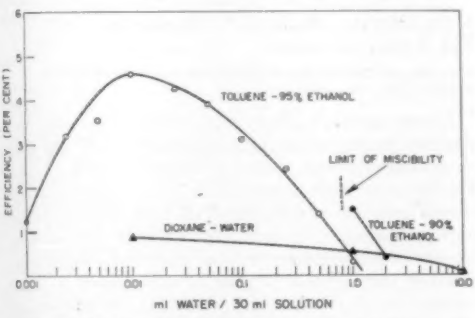

FIG. 1. Efficiency of scintillation counting of tritium water in toluene-alcohol and in dioxane.

When maximum sensitivity is desired, and large amounts of sample are available, the optimal procedure at present consists of using a mixture of 20 ml xylene, 100 mg 2,5-diphenyloxazole, and 10 ml 90% alcohol made from the tritium water sample and absolute alcohol. This procedure gave a counting efficiency of 2.0%, using xylene as the solvent, and 1.5% using toluene.

The principal advantage of using dioxane as solvent is that it is not necessary to add ethanol to produce miscibility of the water sample. However, the efficiency of dioxane as a scintillation solvent is sufficiently inferior to toluene and xylene that the latter solvents provide maximum sensitivity, although dioxane permits the counting of much larger samples.

In the counting range studied all three solvents gave sensitivities comparable to that obtained with a vibrating reed electrometer, as the lower efficiency is balanced by the much greater sample measurable.

Assuming the lower level of significance for the sample counting rate to be 75 cpm above background, the lower limit of detectable specific activity would be

$$\mu c/ml_{lim} = \frac{75}{2.22\times10^6}\,\frac{100}{VE} = \frac{3.4\times10^{-5}}{VE},$$

where V is the volume of the HTO sample in ml and E is the percentage counting efficiency. In the experiment involving 20 ml xylene, 10 ml 90% ethanol, and 100 mg 2,5-diphenyloxazole, this limiting value is 1.7×10^{-3} μc/ml.

The general nature of the dilution effect and the specificity of adsorption problems to tritium water counting were demonstrated by counting C^{14} samples in tritium-free solutions. Efficiencies shown in Table 2 are based on benzoic acid prepared from National Bureau of Standards C^{14}-containing sodium carbonate.

TABLE 2

THE EFFICIENCY OF SCINTILLATION COUNTING OF TRITIUM WATER AND C^{14} BENZOIC ACID IN VARIOUS SOLVENT MIXTURES

Toluene (ml)	30	30	29.9	29.8	29.5	29	28	25	20	10	20	20*	10	30†	29.9‡	29‡	20‡
Absolute ethanol (ml)	0.019	0.0475	0.095	0.19	0.475	0.95	1.9	4.75	9.5	19	9	9	18	20	—	—	—
Water (ml)	0.001	0.0025	0.005	0.01	0.025	0.05	0.1	0.25	0.5	1.0	1.0	1.0	2.0	2.0	0.1	1.0	10
H^3 efficiency (%)	1.3	3.2	3.6	4.6	4.5	4.2	3.9	2.4	1.4	0.3	1.5	2.0	0.4	0.8	0.9	0.6	0.04
C^{14} efficiency (%)	55	54	54	53	52	50	48	39	32	14	31	37	13	23	30	23	24

* Xylene.
† 52 ml total volume and 200 mg 2,5-diphenyloxazole.
‡ Dioxane.

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Concerning the Site of Nitrogen Absorption in Rats Fed Autoclaved or Raw Soybean Oil Meal[1]

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Carroll, Hensley, and Graham (*1*) have concluded that much of the nitrogen absorption in rats fed raw soybean oil meal must take place in the cecum. This conclusion was reached from data showing that the apparent digestibility of raw soybean nitrogen in the terminal 20% of the small intestine was 32.65%, whereas in the feces the value was 76.96%. Values reported for apparent digestibility of heated soybean nitrogen were 78.66% and 81.78%, respectively. This observation presented a notable advance in explaining the lower nutritive value of raw soybeans compared with autoclaved soybeans. It therefore seemed advisable to repeat this work in order to determine the validity of the observations made.

The Cr_2O_3 index procedure was employed in a manner similar to that of Carroll *et al.* (*1*), with the following pertinent notations. The autoclaved and raw soybean rations contained 2.1% total nitrogen and were compounded as in previous studies (*2*). Rats of the Sprague-Dawley strain were fed the respective ration for a period of 4 days before being sacrificed.

TABLE 1

Apparent Digestibility of Soybean Nitrogen in the Terminal 20% of the Small Intestine

Series	No. of rats	Av wt (g)	Apparent digestibility ± SE (range) Soybean oil meal		*t* value
			Autoclaved (%)	Raw (%)	
1	20	126	73.35 ± 1.92 (52.7–84.8)		1.968*
	20	120		66.90 ± 2.66 (43.3–82.8)	
2	21	189	78.52 ± 0.93 (71.7–84.5)		1.644*
	18	186		75.17 ± 1.82 (59.1–86.5)	

* Not significantly different, *t* value according to Snedecor (*5*).

[1] Published with the approval of the director as Paper No. 584, Journal Series, Nebraska Agricultural Experiment Station.

The determination of Cr_2O_3 was carried out by the method of Schürch *et al.* (*3*), except that the dichromate color was read at 375 mμ, as suggested by Dansky and Hill (*4*).

The data accumulated in our experiments indicate that the apparent digestibility of raw soybean nitrogen was not significantly different from the apparent digestibility of autoclaved soybean nitrogen when determined by the Cr_2O_3 index method in the terminal 20% of the small intestine of the rat. The results are presented in Table 1.

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Manuscript received September 22, 1952.

A Test Utilizing the *in Vitro* Clearing of Milk to Determine the Presence of Lipid Clearing Factor in Plasma

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Recent studies indicate that certain physically distinct lipoprotein particles suspended in the blood may be etiologically significant in atherosclerosis (*1, 2*). Following an earlier observation that heparin administered intravenously decreased the turbidity of plasma during alimentary lipemia (*3*), a number of workers have been investigating the possibility that the heparin clearing phenomenon may be of significance in lipid metabolism, particularly in relation to the etiology of atherosclerosis. The clearing effect has been found to occur *in vitro* when lipemic plasma is incubated with plasma withdrawn from donor animals soon after the intravenous administration of heparin (*4*). Subsequent work suggests that a soluble tissue substance, in the presence of heparin, catalyzes the conversion of a precursor present in plasma to a lipid clearing factor. The latter apparently effects a redistribution of plasma lipids in such a way that turbidity is decreased (*5*).

We have been testing for the presence of clearing factor precursor in the plasma of normal and abnormal subjects in connection with our work on postprandial serum turbidity in atherosclerotic patients (*6*). In the course of our study we have investigated the possibility of substituting for lipemic plasma a more easily procured and more readily standardized substance as testing material in the assay of lipid clearing factor. We have found that milk fulfills these requirements reasonably well.

[1] Fellow of the Heart Association of Southeastern Pennsylvania.

TABLE 1

CLEARING OF DILUTED MILK DURING INCUBATION WITH HEPARINIZED PLASMA

Min of incubation	Turbidity reading	
	Control mixture (nonheparinized plasma and diluted milk)	Test mixture (Heparinized plasma and diluted milk)
1	103	94
15	102	85
30	101	80
45	103	80
60	103	77
120	105	74

The procedure consists of a quantitative determination by turbidimetry of the decrease in turbidity obtained in milk when it is incubated with heparinized plasma. After a 12-hr fast a 15-ml control specimen of venous blood is obtained from the subject, and 100 mg of a solution of the sodium salt of heparin is given intravenously. No food is taken during the test period. Fifteen ml of venous blood is then collected at intervals that vary from 1 to 120 min after the administration of heparin. Each specimen is collected in an oxalated tube containing the evaporated residue of 1.5 ml 1.2% ammonium oxalate and 0.8% potassium oxalate. The specimens are centrifuged at 2000 rpm for 10 min, and the supernatant plasma is pipetted off. Three ml of each plasma specimen, including the control, are then thoroughly mixed with 1 ml of diluted fresh homogenized grade A milk previously diluted 1:60 with physiologic saline and preheated to 37° C. The mixture of plasma and diluted milk is then incubated in a water bath at 37° C. Turbidity readings are made immediately after mixing and at various intervals during the next 24 hr in a photoelectric colorimeter, using microtubes. Distilled water is used as a blank, and a red filter (640–700 μ) is used to minimize serum color or slight degrees of hemolysis. We have expressed our results in terms of the direct scale readings[2] obtained in a Klett-Summerson photoelectric colorimeter.

Ten physically normal male psychiatric patients who varied in age from 18 to 30 years were tested. All showed the presence of lipid clearing factor by a variable decrease in turbidity of the diluted milk when it was incubated with heparinized plasma. Clearing activity could be demonstrated in plasma withdrawn as soon as 1 min after the intravenous injection of heparin. In general, maximum clearing activity was noted in plasma specimens withdrawn approximately 10 min after the administration of heparin. Following the incubation of the plasma and diluted milk mixture there was a gradual decrease in turbidity, with a maximum of clearing usually after 2 hr incubation. There was no significant change in the turbidity of the control specimens throughout the incubation. A typical assay of a plasma specimen collected 10 min after the administration of heparin is presented in Table 1.

A comparison of clearing factor activity in the 10 tested subjects revealed variable degrees of activity. In 2 subjects clearing activity was not noted until 1 and 2 hr, respectively, after the injection of heparin. In the remaining 8 individuals the presence of clearing factor was readily demonstrable in plasma specimens obtained 10 min after heparin injection. After 2 hr incubation turbidity decreased 5, 7, 13, 13, 14, 20, 21, and 28 scale units, respectively, in the plasma specimens of these subjects.

The results suggest that the procedure may be standardized as a useful clinical tool in evaluating the possible role of clearing factor precursor in the etiology of atherosclerosis. The study described here is being extended in an effort further to simplify the procedure and possibly to find other lipoprotein substances that may serve as more sensitive indicators of the presence of lipid clearing factor in plasma.

[2] Optical density values may be obtained by multiplying the direct scale readings by 0.002.

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Radioactive Iodine as an Indicator of the Uptake of Iodine by the Liver, Gastrocnemius, and Thyroid of *Rana pipiens*

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Iodine metabolism in body tissues has long been a problem, and until recently the only available methods for following the fate of iodine in the body were chemical determinations or biological assay of tissues. Today, the approach to the problem of iodine metabolism in body tissues can be simplified by the use of the radioactive isotope of iodine (I^{131}), which has a half-life of 8 days. With radioactive iodine tracer techniques it is possible to label the circulating iodine in the organs without altering the amount of iodine already present, since samples of radioactive iodine can be prepared practically free of iodine.

For the most part, such studies have dealt with the accumulation of iodine in the thyroid gland of warm-blooded animals. The present paper, on the contrary, is a report of experiments carried out on the frog to determine the concentration of iodine in hepatic and striated muscle tissue (gastrocnemius), as well as in thyroid tissue.

In these experiments male and female frogs (*Rana pipiens*) of 17–23 g body weight were kept in a

TABLE 1*

Frogs	Sex	Av wt of frogs	Av wt of thyroids	Av wt of livers	Av wt of liver slices	Av wt of gastrocnemius muscles	Av wt of muscle slices	Av count of thyroids	Av count of liver slices	Av count of muscle slices
8	♂	20.3	0.00036	0.91	0.00183	0.72	0.00200	1712	808	475
4	♀	19.9	0.00034	0.93	0.00201	0.67	0.00216	1720	832	431

* The mean values in grams for the weight of the frogs, of the thyroid glands, livers, liver slices, gastrocnemius muscles, and muscle slices of separate groups of male and female frogs; also the mean values for radioactivity counts/2-min interval for the thyroids, liver slices, and muscle slices.

screened cage under dripping water in an air-conditioned room at 5° C. Groups of animals were given intraperitoneal injections of approximately 22.5 μc of carrier-free radioactive iodine in a sodium bisulfite solution. The animals were sacrificed 4 hr after the injection of the radioactive iodine. The thyroids were removed, rinsed in frog Ringer's solution, blotted, weighed, and pressed flat on clean microscope slides; radioactivity counts were made for 2 min with a Geiger-Müller counter. Next, the liver and gastrocnemius muscles were removed from each animal, rinsed in frog Ringer's solution, blotted, and weighed. Thin slices of liver and striated muscle tissue were made with a razor blade, weighed, and prepared for reading as were the thyroids.

The results of these experiments are shown in Table 1. On the basis of recovery of radioactivity, Table 1 shows that the radioactive iodine uptake of the thyroid glands is greater than that of the liver slices, and the uptake of the liver slices is greater than that of the slices of striated muscle.

The weight of the thyroid glands averaged 0.00035 g, the liver slices 0.00192 g, and the striated muscle slices 0.00208 g. The average amount of radioactivity given off for the thyroids was 1716 counts/2 min, for the liver slices 820 counts/2 min, and for the striated muscle slices 453 counts/2 min. Although the average weight of the liver slices is 5.48 times that of the thyroids, and the average weight of the striated muscle slices is 5.94 times that of the thyroids, the thyroids gave off 2.09 times as much radioactivity as the liver slices and 3.78 times as much radioactivity as the striated muscle slices. A comparison of the liver and striated muscle slices shows that, on the average, the muscle slices are 1.08 times as heavy as the liver slices, but the average amount of radioactivity given off by the liver slices is 1.81 times the average for the muscle slices.

The findings reported here indicate that there is a differential iodine uptake by thyroid, liver, and striated muscle tissue of the frog. These findings for thyroid and liver tissue are similar to those of Perlman, Chaikoff, and Morton (*1*) for the rat, and of Chaikoff and Taurog (*2*) for surviving slices of thyroid and liver tissue of sheep. Similar differences between the activities of thyroid and other tissues have been observed by Hertz, Roberts, and Evans (*3*) and by Salter (*4*).

The findings of these experiments may be summarized by stating that the iodine-concentration capacity of thyroid, liver, and striated muscle tissue of the frog, as measured by the uptake of radioactive iodine, showed that the frog's thyroid tissue had the greatest avidity for iodine, liver and striated muscle tissue following in that order.

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Manuscript received September 4, 1952.

Comments and Communications

More on Editorial Prerogatives

(*The following communications are published without editorial alteration.*)

Please refer to "Editorial Prerogatives" (Science, **116** [693–695]).

Now that all other cards probably are down, I'm ready to toss in mine too. Coming this late, my thought will have to make its way strictly on merit, in competition with ideas presumably already formed.

When complaints like this author's are milder, my experience has been that the author has a limited command of English, has not been exposed soon enough in his life to competent editorial work, thinks that the method of expression to which he has accustomed himself is the only possible correct method, and resents any change as if the change were translation into a foreign language. To such an author an extensive vocabulary and a method of expression different from his own actually are a foreign language.

The rumpus that this author has kicked up over picayune matters, however, suggests in both degree and time element that a good course may be to forget him and concentrate on presenting the following ideas:

Every journal and every printing house has its

own standards. Many, if not most of these standards are identical. An author who does not care to welcome the improvement of competent editing under the standards that apply is privileged to go elsewhere, or to publish privately.

Most technical journals already have more manuscripts than they can publish. Publication in a standard journal is a favor to the author. Every person who reads the printed article shows the author equal courtesy.

A complete engineering drawing shows three views. In a correctly edited manuscript, the editor supplies two of the desirable three points of view, his journal's and the readers'.

A competent editor defends the reader from the author and also the author from himself—and once in a blue moon gets thanks for doing so.

HENRY HENDRICKS KETCHAM
Piqua, Ohio

Your issue of December 19, 1952 presents at some length the pros and cons of the situation brought about by the editors of the Quarterly Review of Biology in their treatment of the manuscript of Dr. K. H. L. Key's important review of our knowledge of locust phases. I infer from your editorial note that free and frank discussion of the matter is expected and welcomed.

As one who has worked for some decades with certain aspects of locust research, and also for some years past has had abundant opportunity to know and judge Dr. Key's fairness and ability and his respect for other authors' rights and prerogatives, it is somewhat of a shock to learn the extent to which his manuscript had been altered, *and put into type,* before he had an opportunity to pass upon these many alterations, and in addition many of these changes allowed to appear over his protest.

Having served for nearly two score years as a member of an important publication committee, and as chairman of two such purely scientific committees producing six serial issues, it is exceedingly difficult for me to understand why a manuscript so greatly altered was not returned to the author for his perusal *before* putting it into type. Granted that the Quarterly Review of Biology works on a very tight schedule, and that its editors are unsalaried and do its work on unofficial time, it is in these respects no different from numerous other journals which could be mentioned.

In the past few years I have been having extensive lots of manuscript and proof pass back and forth between Philadelphia and Australia, accompanied by almost weekly relevant air mail letters, these concerning a monograph being prepared here and published by the Commonwealth Scientific and Industrial Research Organization, with Dr. Key the active intermediary and representative of that body. I can say with full knowledge there has been the most courteous and careful regard for the author's wording, and no change, no matter how minor, is made without full air mail consultation *before anything goes into type.* This may be considered in certain directions as a personal and irrelevant matter, but it reflects, at that end, an attitude of mind which I have always maintained as fundamental, i.e. the author's right to the presentation of his arguments as he sees them, subject only to the correction of errors of statement or direct misuse of English. The alternative is the return of the manuscript.

There is in the rejoinder of the editors of the Quarterly Review of Biology at least one statement unworthy of them. Naturally Dr. Key knew exactly what he wished to say and that he felt he was right. It is, or should be, assumed by all publication bodies that this is true of all scientific authors, otherwise they would not, or should not write. Clearly, as the Quarterly Review of Biology editors admit, if 54.4% of the 287 changes made in Dr. Key's manuscript were allowed to stand over his protest made after seeing them for the first—in type—they are obligated to publish one or the other of the two explanatory statements suggested by them, using that which Dr. Key would prefer. This unfortunate and sweeping exercise of editorial power bring more clearly into focus something which has been hanging, like the sword of Damocles, over the biological world, i.e. the regimenting and bureaucratic tendencies which are endeavoring to mold and standardize to a set pattern the scientific publication media in this country. We can only imagine what the reactions of some of our really great scientific master minds of the past, such as Joseph Leidy, E. D. Cope, Elliott Coues and W. M. Wheeler, as well as many others, equally masters of the written word, would have been to such unrestrained use of the blue pencil, with its consequent alteration of their thoughts and intent.

JAMES A. G. REHN
The Academy of Natural Sciences of Philadelphia

The editorial controversy between Dr. Key and the Quarterly Review of Biology is regrettable, but it may be a real service to the technical press to have aired it. Dr. Key's basic complaint, that of over-editing, is one which has been shared by other authors. It may be that there are certain magazines whose editors are chronically guilty, but I am more inclined to believe that it occurs with newer, unmellowed editorial personnel. Several years ago, I also had a paper marked up with hundreds of corrections by the editors of a technical journal of whose Publications Committee I am a member. Almost at the same time, another of my papers prepared with only the same amount of care was accepted and published in the American Journal of Science with no more than half a dozen changes. If the editor in the current controversy believes that his detailed editing is necessary to protect "a literary tradition, as well as standards of scientific excellence," he might contemplate the fact that the American Journal of Science is now 150 years old.

R. E. BIRCH
Harbison-Walker Refractories Company
Pittsburgh, Pennsylvania

The dispute between Dr. Key and the editors of the Quarterly Review of Biology points up what seems to me the worst feature of certain editors of biological journals. I do not have personal experience with these particular editors, but I have had experience with numerous referees and editors, as well as experience as a member of editorial boards and as actual editor of two journals.

The aim of using a referee system is to improve publishable papers primarily by providing the author with the advantage of outside criticism. This criticism presumably operates on the scientific level only, not the literary level—unless one classes ambiguous statements as "literary" rather than "scientific." Most referees confine themselves to the science. A goodly percentage of editors confine themselves to the content of scientific import, to serving as intermediary between referee and author, and to the necessary dealings with the printer. Sometimes there are additional legitimate editorial questions.

Most editors of biological journals are amateurs who perform the task either from a sense of duty or for the prestige resulting. Several of these have impressed me as being very good (an amateur can, of course, be an expert). A few lax editors do little more than act as intermediary between author and printer. But a few of the conscientious editors feel that they are called upon to "polish up" the manuscripts. This usually means rewriting the way the editor would have written had he been the author. When I have disagreed and been sufficiently annoyed to have such changes checked, the outside verdict has been that the change was unnecessary or that the change was inferior because it introduced a discordant style. Sometimes the change actually introduces error, that is the editor changes the wording to make the author say what the editor thinks the author ought to say! Such habits are not merely undesirable, they ought to be intolerable.

In publishing a book recently I found that the University of Minnesota Press had many editorial rules and was more concerned about adherence to textbook-type grammar than I. They queried numerous sentences and even insisted that a few be rewritten, but *they did not presume to rewrite them for me.* Herein lies good editing. A scientific manuscript, like a literary manuscript, is the author's baby; an editor is privileged to accept it or not, to insist on certain rules being followed, and to make suggestions, but he is not privileged to make it into the editor's baby.

On the other hand, many biologists, (at least in the U. S. A.) have not been effectively trained in the art of writing. Commonly an editor has the problem of what to do with a manuscript that seems to represent a good piece of research but is poorly prepared for publication. Even when a manuscript is acceptable, improvement is usually possible and most authors appreciate improvement, as the editors of Q. R. B. point out. I suspect this is usually true both when the changes are "correct corrections" and when they are just recognizable improvements. Certainly I feel that my own papers have been made better by both true corrections and improvements in wording suggested by editors, reviewers and other critics. But these desirable changes have been outnumbered by unnecessary changes to another's mode of expression and by "incorrect corrections." Editors have real headaches and are usually pressed for time but even so they should remember that they are editors, not ghost writers.

A. GLENN RICHARDS
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Scientific Book Register

Progress in the Chemistry of Organic Natural Products. Vol. IX. L. Zechmeister, Ed. Vienna: Springer-Verlag, 1952. 535 pp. Illus. $18.80; clothbound $19.60.

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The Conception of Disease: Its History, Its Versions and Its Nature. Walther Riese. New York: Philosophical Library, 1953. 120 pp. $3.75.

The Decline of the Roman Empire in the West. Schuman's College Paperbacks. Frank W. Walbank. New York: Schuman, 1953. xiii + 97 pp. Illus. $1.00.

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Rapid Chemical Micromethods for the Analytic Fractionation of Serum Proteins. William Q. Wolfson and Clarence Cohn. Ann Arbor, Mich.: Overbeck, 1953. 15 pp. $1.00.

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Social Evolution. Schuman's College Paperbacks. V. Gordon Childe. New York: Schuman, 1953. viii + 184 pp. $1.00.

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J. H. HAGENGUTH

Mr. Hagenguth assumed managership of the Company's High Voltage Engineering Laboratory in 1945.

". . . Thanks to the lightning hunters, among them such illustrious names as Steinmetz, Peek, McEachron, Foust, and Lewis of the General Electric Company, Gross of the American Gas & Electric Company, Schonland in South Africa, and others, we now have a fairly complete story on the lightning stroke formation and the currents involved. By means of photography with rotating film cameras or rotating lenses, we have learned that a lightning stroke generally starts at the cloud in the form of a short streamer of about 150-foot length. This streamer hesitates for about 50 millionths of a second or 50 microseconds and then advances another 150 feet. This process is continued more or less regularly until the streamer reaches the earth after about 1/100 of a second from the start. Here charges of opposite polarity have meanwhile accumulated and as the streamer makes contact, there occurs an interchange of charges at a rate about 100 times as great as the streamer advance. A so-called current peak is produced which may have as much as 200,000 amperes of crest current traveling upward toward the cloud. This is the lightning component that shatters trees and houses.

Probably no two strokes are ever alike. However, we now know quite well the range of the important characteristics of lightning stroke current peaks, such as the time it takes to reach its crest, how slow or how fast it decays, the range of its current amplitudes. All these factors are of importance in the equipment protective field.

In our Pittsfield High Voltage Laboratory we can now develop voltages up to 15,000,000 volts —the voltage in your home circuits is 115 volts or 1/100,000—and currents as high as 250,000 amperes. We, therefore, can and do cover the entire field of effects of lightning on our electrical installations.

G-E Science Forum
Station WGY, Schenectady

E. S. LEE

Mr. Lee, a past president of the AIEE, is editor of the General Electric "Review."

". . . Every engineering student is continually wondering what is beyond his student life, what is ahead of him in the great adventure in which he has made a start. The step into industry looms large. The picture of the road ahead is never clear.

And yet this need not be. If he will only realize it, he has been privileged to have the opportunity to obtain the finest education it is possible to provide. He has been associated with teachers who brought to him a knowledge of the fundamentals of engineering in practice and as a profession. And in these associations he has learned to live with his fellow men.

He has learned of the phenomena of Nature in his physics, which is fundamental. He has learned of the materials of Nature in his chemistry, and with these he will live throughout his engineering life. He has learned to write a phenomenon of Nature in the one-line equation of mathematics, to operate upon that equation to obtain a relationship of the variables involved, and to plot those variables in order to see the phenomenon in all its beauty and its usefulness.

For the phenomena of Nature are beautiful, and it is to the honor of the scientist and the engineer to search them out and make them available to mankind in the products of industry. These are the prize possessions of the engineering student; and industry provides him with the opportunity to make use of them. This is not new. It has always been that way.

The opportunities for new advances never cease. Even after 75 years of continuous engineering achievement, the engineer is still opening new doors. Whether these lead to the development of new products, or to the improvement of present ones they represent opportunities for every engineer. Of these there is no end. Engineering *is* a great adventure!

General Electric Review

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